ENLARGEMENT OF THE PROSTATE

DEAVER

ENLARGEMENT
OF THE PROSTATE

Its History, Anatomy, Ætiology, Pathology, Clinical
Causes, Symptoms, Diagnosis, Prognosis, Treat-
ment, Technique of Operations,
and After-treatment

BY

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ASSISTED BY

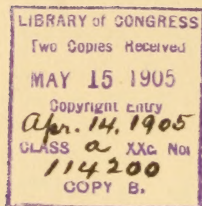## ASTLEY PASTON COOPER ASHHURST, M.D.

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PLATES AND A COLOURED FRONTISPIECE

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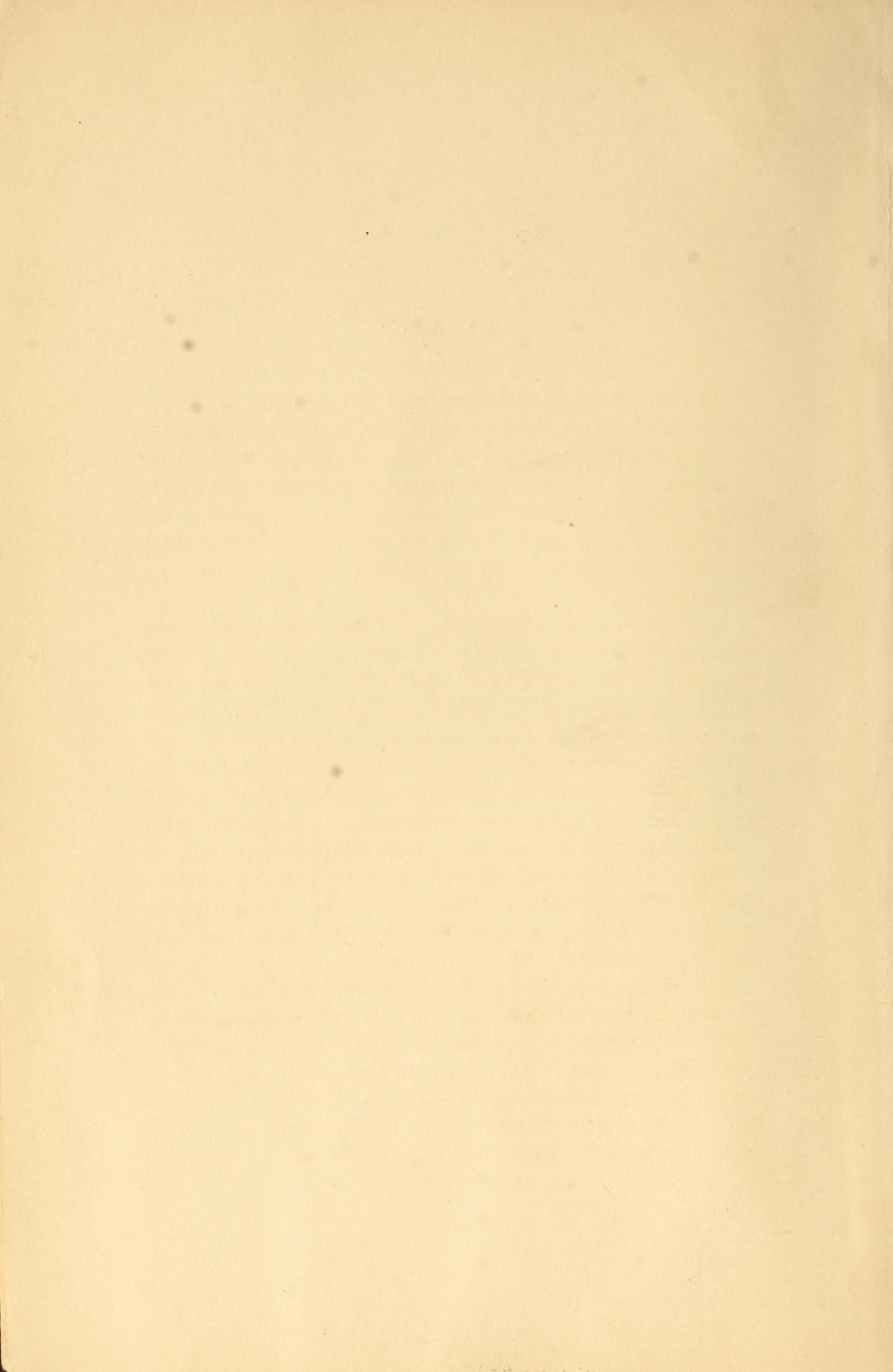
PREFACE.

The surgery of the prostate gland has acquired within the last few years such a conspicuous position in both surgical literature and practice, that the publication of another text-book on the subject can scarcely be a matter of surprise. And as the author has had considerable experience, both operative and otherwise, with prostatics, it was not unwillingly that he complied with the request of his publishers to write a monograph on this subject.

In preparing this volume, the aim has been to produce a work fully representative of the subject of which it treats. While the results of the author's own experience have been included, he has taken pains not to remain uninformed of the opinions of other surgeons. A conscientious search and study of prostatic literature has therefore been made, to the end that no personal bias should infect the principles of diagnosis and treatment which it has been endeavoured to inculcate. The present work, therefore, claims to be more than a mere compilation of the ideas of others; the author has not hesitated to hold his own opinions when these have seemed preferable, and he has tried to present the reasons for these opinions in such a way as to command the attention which he thinks they deserve.

The illustrations have been chosen with great care. They are in most cases original, but where it proved impossible to obtain original material, selection has been made of those which most nearly presented the requisite characteristics. Although an attempt has been made—and, the author ventures to think, not without success—to illustrate every important phase of prostatic surgery, both pathological and clinical, as well as opera-

tive, yet in no instance has a plate been introduced which was not considered illustrative of the text. All the illustrations have been drawn by Mr. C. F. Bauer, except the microscopical plates, which were prepared by Mrs. J. D. Z. Chase, under the direction of Dr. A. O. J. Kelly.

The treatment, other than operative, has been discussed in greater detail than may seem warranted to some; but realizing that this forms by far the largest part of actual practice, it has seemed wise to the author to consider it at length.

In concluding a work which has occupied much of his time for over a year, the author desires to express a hope that the volume will prove of real value to those surgeons and family physicians who have prostatics under their care, and will serve in some little degree to elucidate the principles of surgical treatment of one of the most distressing maladies of mankind.

1634 WALNUT STREET,
    May, 1905.

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ENLARGEMENT OF THE PROSTATE.

CHAPTER I.

HISTORY AND LITERATURE.

It is a remarkable thing that any part of the human body liable to such important pathological changes as the prostate gland should have acquired a conspicuous place in surgery within such comparatively recent years. Its very existence was unknown until the beginning of the sixteenth century, and it is only within the short space of a decade that its operative surgery has been deemed of sufficient magnitude to require exposition in monographs of any size.

The symptoms of this malady, if we may believe Sir Everard Home [123],* have been recognized from time immemorial. This ingenious author surmised that the enlargement of the prostate gland met with so universally in old age is "alluded to in the beautiful description of the natural decay of the body, in the Bible, in the book of Ecclesiastes, the 12th chapter, the 6th verse, where it is written, 'or the pitcher be broken at the fountain, or the wheel broken at the cistern,' Expressive of the two principal effects of this disease, the involuntary passing of the urine, and the total stoppage."

From scattered observations among the works of the classic authors it appears that these writers considered that patients with prostatic hypertrophy suffered from "excrescences" or "carnosities" at the neck of the bladder; and that when these outgrowths offered obstruction to the evacuation of the bladder

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* The figures throughout the text enclosed in brackets [thus] refer to the corresponding numbers in the Bibliography, pages 243 to 252.

their destruction was attempted with metallic instruments, intro-
duced, of course, through the penile urethra. Certain of the
ancient authors recommended incision of the neck of the blad-
der through the perineum in patients with retention of urine who
were "nearly dying with the pain," when the urethra was much
inflamed, and therefore impassable to the catheter, even if no
calculus existed to serve as an excuse for lithotomy; but it is
not known that they actually performed such an operation.

The ignorance of the ancients as to the anatomical existence
of the prostate may be explained on the hypothesis that they
did not practise dissection of the human body. According to
Galen [94], Herophilus first employed the term "prostate,"
which he, however, appears to have applied to the seminal vesi-
cles (ἀδενοειδεῖς προστάται, "prostatæ glandulosæ"), while the term
κιρσοειδεῖς προστάται, "prostatæ cirsoides," appears to have repre-
sented the ampullæ of the vasa deferentia. It should be recalled,
to excuse Herophilus for his apparent confusion of terms, that
the prostate gland of the lower domestic animals, as well as
that of monkeys, is a bifid organ, much resembling in some cases
the human seminal vesicles.

Except for this brief reference, no mention whatever of the
prostate gland is to be found until the sixteenth century. Its
discovery is attributed to Nicolò Massa, a Venetian physician,
who died in 1563. Riolanus [200], about the middle of the six-
teenth century, was the first to suggest that the bladder could
be obstructed by a swelling of the prostate. In several cases of
urinary retention this surgeon successfully practised incision of
the neck of the bladder through the perineum, but it is not re-
corded whether the cause of the retention was enlargement of
the prostate gland.

John Hunter [128], Sir Everard Home [124], Brodie
[33], and others, both recommended and practised tunneling
of the obstructing body by the catheter; but this remedy was
finally abandoned as dangerous. Chopart [47] records that

PLATE I.

Tunneling the Prostate. A False Passage has been Made in the Dilated Prostatic Urethra.—(*Cruveilhier.*)

when Astruc, ten years before his death, which occurred in 1766, was attacked by retention of urine, his attendant, Lafaye, attempted to introduce a catheter, but met with an obstruction from a tumor in the neck of the bladder. He therefore perforated this by a lance-shaped stylet introduced through the catheter, which was open at the end; and by this means succeeded in forcing the catheter into the bladder and drawing off the urine. The catheter was retained fifteen days. This false passage through the obstructing body persisted, and a catheter was introduced by 'it as occasion required through the remaining ten years of Astruc's life; and the condition of the parts as described was finally confirmed by the post-mortem examination. Chopart [47] himself tried tunneling of the prostate several times, but with fatal results. Billroth's [22] experience was likewise disastrous in the only case in which he used forced catheterization.

Systematic compression to maintain a patulous urethra was first proposed by Physick [193], of Philadelphia. His method consisted in the introduction of an elastic hollow tube through the compressed prostatic urethra, as a catheter, and then its distention by fluid pressure. Some success attended this remedy; and it was repeated every two or three days, the pressure being applied for as long a time as the patient could endure, usually from five to fifteen minutes. Leroy d'Étiolles [145] and Mercier [159] also made use of compression, in an effort to reduce the size of the prostate, or at least to mould it in its growth. Their plan consisted in introducing a flexible catheter, and then plunging into it a straight stylet, which forcibly overcame the natural subpubic curve of the urethra. Special instruments were designed for this purpose; but the remedy was so extremely painful in its application that it met with little general favour. The contemporary English surgeons, moreover, contended, and apparently with an element of truth, that no more was thus accomplished than by passing an ordinary steel sound through the urethra

until its curved extremity was wholly within the bladder, when its straight staff would tend to depress the internal orifice of the urethra to its normal position. But probably the best-known advocate of systematic compression was Mr. Reginald Harrison [110], of London. This surgeon, in 1881, devised special olivary bougies, of gum elastic, from two to four inches longer in the stem than the ordinary instruments, and having an expanded portion an inch from the tip, which was made to enter the bladder. By this means the olivary swelling caused dilatation of the urethra and compression of the prostate both as the instrument was introduced into the bladder, and again as it was withdrawn, it being allowed to remain in place for several minutes.

As is the case with every other department of surgery, operative treatment was at first undertaken only in emergency cases, where retention of urine existed; or incidentally as part of another operation, such as lithotomy.

Perineal operations came into favour earlier than those by the suprapubic route, owing probably to the greater familiarity of surgeons with operations in the former region, due to the then widespread practice of perineal lithotomy. Covillard [53] in 1639 successfully operated by perineal cystotomy, and removed a hard mass, not a stone, crushing and destroying it during extraction with the forceps. This was an isolated case, not undertaken for urinary retention, and does not represent the usual practice at that date. Sir Henry Thompson [224], in referring to this case, asserts that the "hard mass" was a true tumor of the bladder; but Gouley [100] seems to have considered it prostatic.

Chopart [48] describes how Desault, who died in 1795, found and twisted off a tumor in the bladder, after removing a calculus by perineal lithotomy; and Sir William Blizzard [25] several times before 1806 performed perineal prostatotomy for enlargement without any calculous formation. It has been

PLATE II.
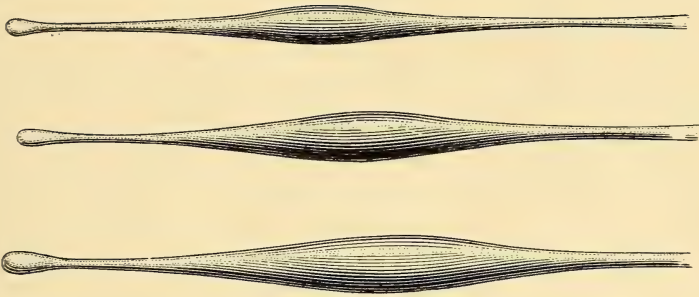
HARRISON'S OLIVARY BOUGIES.

denied by some writers that Sir William Blizzard's operations were anything more than the opening of prostatic abscesses; but he distinctly says that his object in performing such an operation was to reduce the size of the gland by incision, irrespective of the presence of pus, which he says may have been absorbed, only induration remaining. (See Guthrie [107], p. 252.)

Perineal prostatotomy combined with lithotomy was by no means unfrequent in the early part of the nineteenth century, and was sanctioned by Sir William Fergusson [78], who employed this procedure before 1848.

Amussat [6] removed a calculus and a protruding mass of the prostate by suprapubic cystotomy before 1832.

But the first regular surgical procedure was established in 1834 by Guthrie [107], under the name of "division of the bar at the neck of the bladder," this bar in some cases being produced by a fold of mucous membrane stretched taut across the vesical orifice of the urethra by symmetrical enlargement of the two lateral lobes of the prostate. He accomplished his purpose by a catheter carrying a concealed blade. Where marked prostatic enlargement coexisted, he advised perineal prostatotomy, but it is not certain that he ever performed it. Mercier [159], whose name is pre-eminent in the early days of prostatic surgery, devised in 1837 special instruments—called by Gouley [100] "prostatotome" and "prostatectome"—and at later dates modified them in various ways. These instruments were all used much as the internal urethrotome is used at the present day, without either a suprapubic or a perineal opening; and did not meet with very general favour. Leroy d'Étiolles [145] as well as Civiale [159] claimed priority over Mercier [159] in the invention of instruments for the operation (urethral prostatotomy) since known by the latter's name; but it appears that their claims are ill founded. Indeed, so occupied were they with one another's claims that they seem to have at times entirely overlooked the fact that Guthrie [107] was the originator of the method.

A further improvement on Mercier's method was that introduced about 1873 by Bottini [27 and 28], then of Pavia, who aimed to avoid the hæmorrhage attendant upon Mercier's operation by the use of a galvano-caustic incisor. Gouley [100], however, who had considerable personal experience with Mercier's method, which he nevertheless preferred to apply through an external urethrotomy wound, asserted that the bleeding was trifling, and that therefore Bottini's modification was unnecessary. Although the Bottini operation was enthusiastically practised by its originator and a few other Italian surgeons during the twenty years or more following his first description of it, yet it by no means met with general favour until after the publication in 1897 of the well-known paper by Freudenberg [80], who introduced many improvements in the requisite apparatus. This surgeon four years later recommended the addition of a centimetre scale to the shaft of the Bottini cautery, in order that the operator might have a more definite idea of the position of the beak of the instrument when in use. Further modifications of the galvano-caustic apparatus have recently been introduced by Dr. H. H. Young [260], of the Johns Hopkins University, the greatest advantage being that the slipping away of the prostate from the beak of the instrument is rendered nearly impossible, and that thus the risk of burning through the bladder wall instead of through the hypertrophied gland is minimized.

In America Dr. Willy Meyer [163 and 165], of New York, and Dr. Orville Horwitz [125], of Philadelphia, have been among the most prominent advocates of the Bottini method to the practical exclusion of all others.

Belfield in 1886 advocated the employment of Bottini's method through a perineal wound. His advice has been reiterated by Watson (1888) [242], Keyes, Jr. (1902) [134], and Wishard (1902) [253]; while Watson (1888) [242], Bangs (1898) [12], and Bouffleur (1902) [31] also recommend the employment of a cautery through a suprapubic opening.

PLATE III.
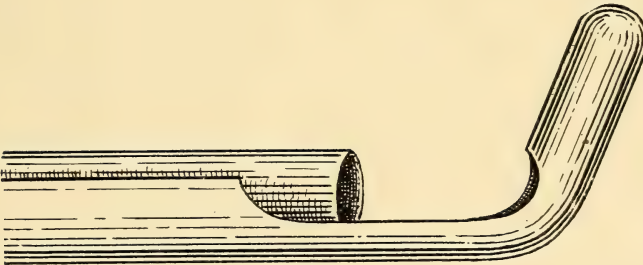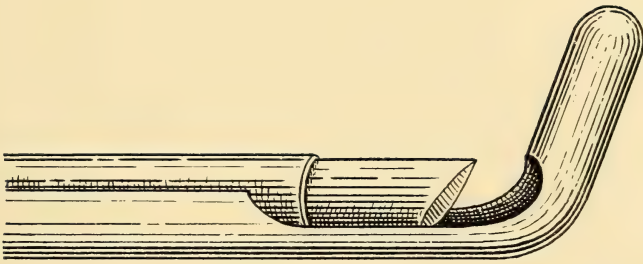
MERCIER'S PROSTATOTOME AND PROSTATECTOME.

Meanwhile various other methods of treatment had been introduced. Of these, the most important are those that arose from the practice of tapping the bladder in cases of retention of urine where passage of the catheter proved impossible. Simple catheterization to relieve the bladder of its residual urine had long been employed; Home [123] had even used continuous catheterization—for periods of from one to three months—for the relief of the cystitis. It is interesting to note that the clever manœuvre of increasing the curve of the catheter by partially withdrawing the stylet as its beak approached the obstruction was practised and taught by Physick [193], the Father of American Surgery, long before it was accidentally discovered by Mr. Hey. Dorsey figures in his "Surgery," published in 1818, a catheter with the well-known prostatic curve, which is in this case exaggerated, and, as Dorsey says, is probably as great as will be found necessary in any case of enlargement of the prostate. The instrument known as the "elbowed catheter" of Mercier, originally of silver, and devised by him as a modification of the stone searcher, is now usually made of webbing, and has been found most useful in gaining access to a bladder with prostatic obstruction by the facility with which its point rides over the projection at the vesical orifice of the urethra.

Where it was found impossible to introduce the catheter, the bladder was punctured, either suprapubically or through the rectum. Perineal puncture, though practised during the seventeenth and eighteenth centuries, fell into disuse during the early part of the nineteenth, the rectal route being the favourite. Suprapubic cystotomy for urinary retention is an operation over three hundred years old, having been advocated by Rossetus [202] in 1590; but it was feared by most surgeons, in the early part of the nineteenth century, that in employing suprapubic puncture there would be great danger of urinary infiltration among the layers of the abdominal wall; and since it was found that in many instances, even after the cannula was withdrawn,

the rectal puncture served fairly well for micturition until the urethra again became patulous through the subsidence of inflammation, this was the operation usually adopted. Toward the middle of the last century some surgeons returned to the suprapubic route, while others considered a perineal puncture the only sensible treatment; and rectal puncture was cast aside almost wholly.

From these various procedures arose finally a new method of treatment—that by urinary fistula; and from the concomitant drainage of the bladder it may be considered a distinct advance in therapeusis. Needless to say, some of the patients treated as above described, by puncture of the bladder for retention of urine, developed fistulous tracts which failed to heal. Thus Parrish [189] records that a patient whose bladder had been tapped suprapubically for prostatic retention by Dr. Wistar (who died in 1818) wore a gold tube in the fistula for two years; at the end of this time normal urination through the penis returned, and the tube was discarded, with the result that death soon followed from a recrudescence of the bladder troubles. This operation had been done, like innumerable others, for prostatic retention where the urethra was impassable; and Sir Henry Thompson [225] narrates that he saw some patients of Mr. Thomas Paget, who had had their bladders punctured suprapubically, completely relieved of the tenesmus and other distressing features by wearing a cannula or a catheter in the suprapubic fistula; and that this sight gave him encouragement to try the effect of permanent drainage even in patients where retention of urine was not complete, and where the urethra was still open to instrumentation. When a suitable case presented itself, he accordingly introduced through the urethra a long curved metal catheter, whose point was closed by a conical obturator (Plate IV); and, making this point impinge upon the wall of the bladder above the pubic symphysis, cut down upon it with a small incision. He then caused the catheter to protrude through the suprapubic

PLATE IV.
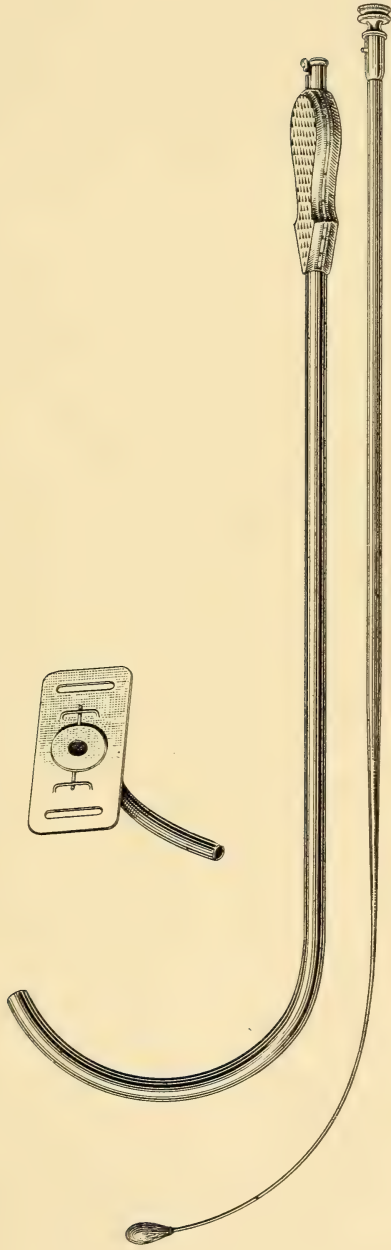
SIR HENRY THOMPSON'S INSTRUMENT FOR ESTABLISHING A SUPRAPUBIC FISTULA.

wound, withdrew the obturator, passed a cannula like a tracheot-
omy tube into the point of the catheter, and by withdrawing
this latter through the penile urethra, left the suprapubic tube
in the bladder. Sir Henry Thompson's observations were first
published in 1875, and in many cases in which he employed this
method the relief afforded was marked, but he later abandoned
this plan of treatment for drainage through the perineum. Dittel
[69, 70], Keyes [131], and Swinford Edwards [75] were among
the other surgeons who at one time or another recommended
the suprapubic fistula.

An important improvement in the method of forming the
suprapubic fistula was that introduced in 1888 by Hunter
McGuire [155]. He formed an artificial urethra in the hypo-
gastric region by establishing a fistulous tract upward from the
bladder, so that the fistula "bore the same relation to the bladder
that the spout of a coffee pot does to the bowl." By this pro-
cedure McGuire was able to completely relieve his patients
of their cystitis and residual urine, no involuntary leakage
occurring even in the supine position, and the patients in some
instances being able to project the stream of urine in a parabolic
curve to a distance of several feet by voluntary contraction of
the bladder. The urine was retained for from two to six hours.
Morris [171], of New York, in one instance clothed the fistulous
tract with skin by transferring narrow cutaneous flaps into the
wound at the time of operation. Poncet and Delore [194] have
exhaustively studied the subject of suprapubic fistula as a means
of treatment for patients with enlarged prostate; and the reader
is referred to their work for further information. It is interesting
to note that Delore [59] collected three cases where patients
who had had urachal fistulæ in childhood had these open again
spontaneously when in old age they developed prostatic reten-
tion.

The treatment by perineal fistula developed as a natural con-
sequence of puncture by the perineum, and from the practice

of perineal cystotomy for calculus complicated by enlarged prostate. Besides the mere cystotomy, it was customary to do a prostatotomy, and even a digital divulsion of the obstructing organ. The establishment of a perineal fistula with perineal prostatotomy was a method largely employed by Reginald Harrison [111], commencing in 1881, his first operation having been performed on November 4th of that year. He used a small perineal incision, opening the membranous urethra; then the prostate was incised; and a metallic perineal tube introduced and retained for from six to twelve weeks. If the natural channel was not eventually restored, the fistula persisted. Prof. Gouley [100], of New York, claimed priority over Harrison in the re-introduction of perineal prostatotomy, his first operation—in which, however, he left no instrument in the bladder—having been performed April 27, 1880; and his third operation, in which he left a large-sized rubber tube in the perineal wound, having been done in January, 1881. Whitehead [249] and Braun [32] were likewise among the earlier advocates of the treatment by a more or less permanent perineal opening.

Various other methods of treatment, supported by different surgeons, have, at one time or another, claimed the attention of the profession. Heine [119] recommended the injection of iodine into the prostate, and Langenbeck [143] and Iversen [129] the subcutaneous use of ergotine, in the hope of causing a reduction in the size of the gland. The parenchymatous injections were given through the rectum, but in some cases treated by Heine's method (see Dittel [68]) it was found that suppuration and even death followed, so that this practice was never very generally employed. Electricity has been employed in these cases, and at times with a certain measure of success; although the cases so reported are open to the criticism of having possibly been merely those of chronic prostatitis, and not of true enlargement. This method has been carefully studied by Chéron and Moreau-Wolf [169], to whose excellent monograph the reader is referred.

PLATE V.
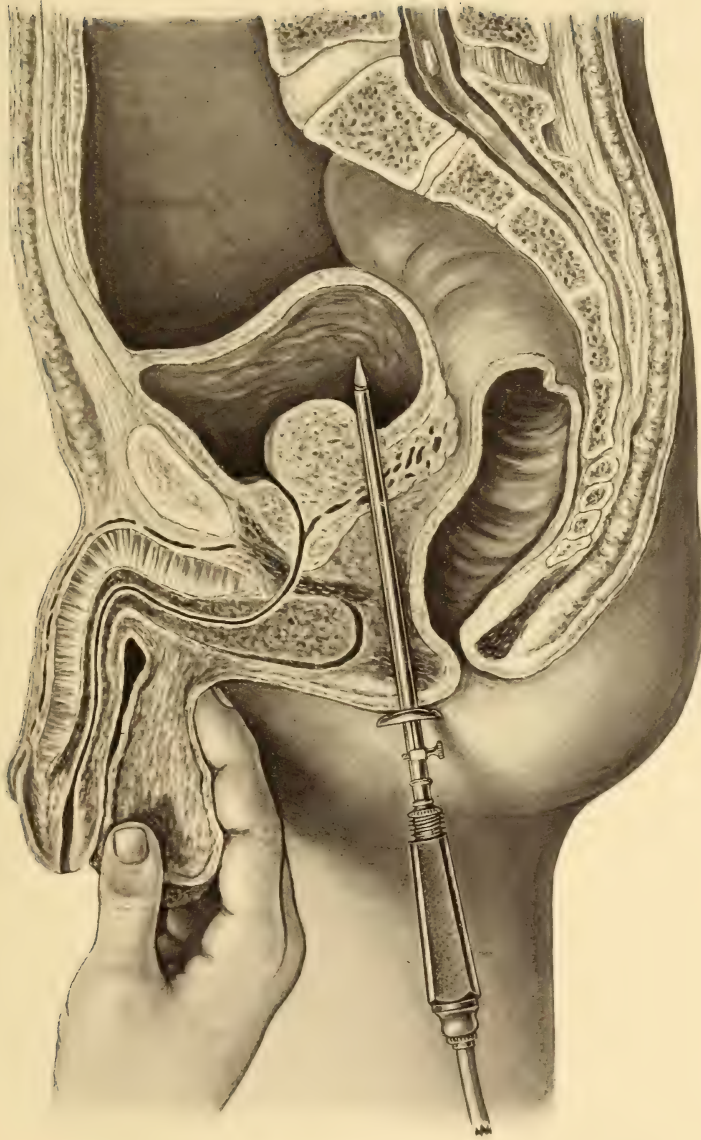
TAPPING THE BLADDER FROM THE PERINEUM, IN THE CASE OF AN ENLARGED PROSTATE.—(*After Ashhurst.*)

Excision of the obstructing parts of the enlarged prostate by suprapubic cystotomy was first widely advocated by McGill [152], of Leeds, in 1887. Before this date he had practised permanent suprapubic drainage, which he preferred to that by the perineum. Belfield [16], in America, had done suprapubic prostatectomy before this time, his first operation being in October, 1886; Dittel [71] had in 1885 removed a portion of an obstructing prostate through a previously existing suprapubic fistula, which he enlarged for the purpose; Trendelenburg [230], in May, 1886, and Benno Schmidt [208], in August of the same year, had employed this route for removal of pieces of the prostate; but to McGill has always rightly been attributed priority in bringing this procedure prominently before the profession. The most enthusiastic supporters of McGill's operation have been Buckstone Brown [34], Kümmel [140], Atkinson [11], Keyes [131], and Fuller [92].

As originally practised, this operation consisted in cutting off, through the usual incision of suprapubic cystotomy, by means of scissors, or of rongeur forceps (Keyes) [131], twisting off with bladder forceps, strangulating with an écraseur (Tobin) [228], or crushing with a lithotrite, any projecting masses of prostatic tissue. It was, however, in time extended so that portions of tissue, forming the so-called prostatic tumors, were enucleated with the finger, either alone, or aided by the scissors or other instrument, from their position deep within the gland. There are not wanting, indeed, surgeons—among them Watson —who claim to have removed the entire prostate gland by a procedure strictly similar to that recently so ably advocated by Mr. P. J. Freyer [85 to 90]; but as they do not appear to have thought the profession in general worthy of their confidence until stimulated by the reports of Mr. Freyer, to that surgeon is undoubtedly due the credit of bringing (1901) before the medical world a plan of operation whereby an attempt is made to enucleate the whole organ. Through a suprapubic incision he opens

the bladder, and incises, by a cut parallel to the urethra, the mucous membrane overlying each of the two lateral lobes of the affected gland. Then by working merely with the finger he states that he has been able to enucleate the entire prostate, leaving the urethra intact.

Many other surgeons have laboured to prove that such an operation is not only surgically, but even anatomically impossible, assailing Mr. Freyer's claim to originality, and asserting that he is labouring under a grave misapprehension if he thinks he is the first person to operate in this manner; insisting that his method is nothing more than the removal of very large prostatic tumors from the substance of the gland, leaving behind the outer margin of glandular tissue which by the growth of these tumors has been compressed into a thin capsule-like layer. Thus Wallace [239] says: "The more rapidly growing areas (of the diseased prostate) increase at the expense of the more slowly growing ones, which are compressed and stretched over the surface of their quickly growing neighbours. By this process a capsule is formed, ill-defined at first, but later becoming more distinct. The elements forming this capsule show in process of time a lamellar disposition. The adenomatous mass can now be easily enucleated, and not only presents a smooth surface, but also leaves behind a smooth cavity." One "capsule" which he describes, left behind after the post-mortem removal of the prostate, showed within its layers a small lenticular focus of glandular tissue. He therefore concludes: "These facts . . . seem to leave no reasonable doubt that the so-called total prostatectomy is nothing more than the removal of adenomatous masses." Yet he admits that "if during life the urethra had been sacrificed, and the whole central mass removed, the operator would have been justified in believing that he had removed the entire organ; certainly nothing recognizable as prostate would have been left behind." Taylor [222] entirely concurs in the opinion above expressed by Wallace, to the effect that total

enucleation of the prostate gland is an impossible operation; but Roberts [201], as the result of a careful examination of the structures left after a post-mortem enucleation of the prostate gland by Freyer's method, is of the opinion that the whole gland can be removed during life, since in his experience just alluded to no trace of prostatic tissue could be found remaining behind. The studies of J. W. Thompson Walker [236 to 238] confirm the opinion of Roberts.

It seems a pity that so many controversies in regard to surgical priority are so constantly arising, and it appears that prostatic surgery is particularly unfortunate in this respect. Riolanus [200] bitterly denounced his contemporaries for claiming as their own operations which had been employed before their grandfathers were born, and for a hundred years before even that time. Mercier [159] asserted that Civiale and Leroy d'Ét-iolles had assumed the credit of operations which were not their own, and, with that delightful tendency toward the *argumentum ad hominem* characteristic of the French nationality, added that Leroy had also assumed a name to which he had no right, since in reality Leroy was from Paris, not from Étiolles. Gouley [100] spoke almost venomously against Mr. Harrison; and I think Mr. Freyer would be well able to respond to his critics as Harrison [115] did to Prof. Gouley: "I see that Dr. Gouley claims priority for the proceeding just described; what is of more importance is that it has received his approval."

Whether or not every shred of prostatic substance is removed by Freyer's operation is of very little consequence; who first performed such an operation is of less; and whether it is ana-tomically possible or not is of no consequence at all; since the results in Mr. Freyer's cases speak for themselves, and he has aroused the profession, not only in his own country but in France and America as well, to the realization of what a brilliant chapter of prostatic surgery is unrolled in his achievements. Indeed, were I inclined to criticize the reports of Mr. Freyer's cases in

any way, it would be to say that they were almost too good to be believed, except when coming from such a source, so much like a fairy story do they read.

Freyer's operation has been ably illustrated by Moynihan [178] and by Barling [13].

Prostatectomy by the perineal route followed close on the practice of perineal prostatotomy, and preceded by a number of years McGill's introduction of the suprapubic method. Employed first for malignant disease (by Küchler [139] in 1866, by Billroth [21] in 1867, by Demarquay [61] in 1873, by Langenbeck [143] in 1876, by Spanton [213] in 1882, and by Leisrink [144] in 1883), its field of application was soon broadened so as to include benign enlargement. At first, as in the parallel case of the suprapubic operation, portions only of the prostate were removed, but within the past ten years the technique has so much improved that total prostatectomy by the perineal route is even more widespread than that by the suprapubic method. Many prominent surgeons have advocated the perineal route, including Harrison (1881), Ashhurst (1882), Annandale (1888), Zückerkandl (1889), Watson (1889), Dittel (1890), Goodfellow (1891), H. Morris (1895), Ferguson (1901), Syms (1901), Albarran (1901), Petit (1902), Moore (1902), Murphy (1902), Bryson (1902), Young (1903), Senn (1903), and Proust (1903).

The simplest perineal operation is done through a straight median incision. It is that which I have myself employed, and which was almost universally used until within the last few years. Goodfellow [98] is among the few surgeons who employ it still; and through it he has removed the entire prostate, much as Mr. Freyer does through a suprapubic opening, since 1891, being a pioneer in this field. To gain more room some surgeons have supplemented the median incision by an oblique cut on each side of the anus, making an inverted Y-shaped incision; this method has been advocated by Murphy [181], Baudet [14], and Senn [209]; while Zückerkandl [263] advises a

transverse semicircular incision, making a flap toward the rec-
tal aspect, this tube being separated from the anterior structures
by blunt dissection.   A similar though less extensive skin flap is
employed by Albarran [2], Proust [196], and other French sur-
geons, as well as by Young [260], who closely follows their
technique.   Dittel [72] aims to get still more room by an in-
cision completely encircling the right side of the anus from
the coccyx, and continued forward in the median line of the
perineum; by this approach he is enabled to remove a wedge-
shaped piece of each lateral lobe.   The coccyx may be excised
if more room is required for completing the operation.

The position used for these variously modified operations
differs somewhat: thus, although the usual lithotomy position
suffices for most surgeons, many prefer to have this much exag-
gerated, while Proust [196] mounts his patients on a sort of frame-
work, so that the perineum is completely inverted.   Dittel [72]
employs either the right lateral decubitus, or else has the patient
placed on the table in the prone position, with the thighs hanging
vertically downward.

These perineal operations all differ much in some minor
details of technique, as to whether the urethra is opened or not,
whether an attempt is made to preserve the ejaculatory ducts,
and as to the special instruments employed; some of these
matters will be discussed in the last chapters of this book; but
for such as appear of purely historical interest the reader must
consult the original articles referred to in the appended biblio-
graphy.

Combined operations, by the perineal and suprapubic routes,
have found a number of supporters.   Nicoll (1895) [183] removed
the gland through the perineum, aiding its extraction by pushing
the prostate down by the fingers of one hand introduced into
the bladder through a suprapubic wound. Alexander (1896)
[4] removed it through a suprapubic cystotomy by the aid of
the fingers of the other hand in a perineal wound.   Bryson (1899)

[36] and Guitéras (1901) [106] have employed a perineal operation in which counterpressure is afforded by the fingers introduced through a suprapubic incision only into the space of Retzius; while another enthusiastic surgeon (Syms) [220], thinking the extraperitoneal opening of an infected bladder too dangerous an operation, has proposed freely opening the peritoneal cavity and conducting the manipulations for counterpressure through the unopened bladder-walls, while the prostate is extracted through the perineum. Fuller (1895) [92] did a suprapubic prostatectomy, and then drained by means of a perineal cystotomy, completely closing the suprapubic wound on the removal of its drainage on the fourth day.

Other operators have devised special instruments by which to draw the prostate down into the perineal wound without making any suprapubic opening. Murphy [181] employs hooked retractors which grasp the gland from its lower surface; and Syms [220] uses a special hollow rubber retractor, introduced into the bladder through a perineal incision in the membranous urethra, the instrument being kept in place by distending its bulbous extremity with water. Proust [196] and Young [261] each employ a special prostatic tractor; but most surgeons have found it sufficient to use an ordinary steel sound, or stone-searcher, introduced through either the penile urethra or a perineal urethrotomy wound, making traction by inverting the curved end over the enlarged prostate.

A mode of treatment by castration, advocated in 1893 by J. William White [247], though widely employed by some surgeons for several years, is no longer in favour. White suggested this method in June, 1893; in September of the same year Ramm [197], of Christiania, published the results of castration on two patients, on whom he had operated the preceding April. Boeckmann [26] had done a similar operation in May, 1893, and it appears that Tupper [231], on two occasions, in 1882 and 1886, had performed this operation with the deliberate

intention of relieving prostatic troubles, after having seen the effect produced by the removal of the remaining testicle from a patient whose first testicle had been removed for other causes. Ssnitzin [214] had employed this operation in 1886. Launois, according to Moullin [176], suggested this form of treatment to Guyon in 1884; and Mr. Moullin himself discussed its advisability with a patient in 1892.

All of these observations were much antedated by those of John Hunter [128], who, in experimenting on animals, had shown that double castration in young animals prevented the developement of the prostate, and that in adult animals it caused the fully developed gland to atrophy and waste away. It had, moreover, been known for many years that in certain animals, such as the mole, which have stated periods for sexual intercourse, the prostate is much diminished in size during the intervals, and hence it was inferred that a continuous abeyance of the sexual function would cause atrophy of the prostate in men. Vasectomy was suggested by Mears [158] as a less severe and mutilating operation, and seems likely to continue in use for certain cases for a longer time. The mortality from castration for enlarged prostate is at least 18 per cent. (White) [248], taking all cases together; and in selected cases has been reduced only to about 8 per cent. (Wood) [257]. Griffiths [105] and Mansell Moullin [175] have been its chief advocates in Great Britain.

Ligation of both internal iliac arteries to induce ischæmic atrophy of the prostate was proposed in 1893 by Bier [19], and employed by him in three cases, one of the patients, operated on intraperitoneally, dying from septic peritonitis. Of eight patients subsequently operated on intraperitoneally by Bier, two died. Willy Meyer [160, 161] practised this operation in three cases, the first patient recovering, after secondary hæmorrhage and partial gangrene of the left foot; but the second died, apparently of renal disease, eight days after the operation; while

3 P

the third was in nowise benefited by his experience. König [136] also reported one patient, operated on by another surgeon, in Chicago, no change in the urinary condition being produced. Of those patients who survived (eleven out of fifteen), eight are said to have had their bladder troubles more or less relieved, while three received no benefit whatever, and four died, a mortality rate of over 26 per cent. Derjuschinsky [63, 64] investigated this method of treatment by conducting experiments upon dogs, and demonstrated that although primary decrease of size of the prostate occurred, yet that at about the end of eight months' time it had regained its original volume by virtue of the establishment of the collateral circulation. I do not wish to be understood as countenancing this method in any way, and mention it merely as a matter of historical interest.

Among the more important monographs which have appeared at various times, treating of diseases of the prostate gland, mention should be made of those by Sir Everard Home (1811), Leroy d'Étiolles (1840), Coulson (1840), Adams (1851), Hodgson (1856), Thompson (1858), Gant (1872), Harrison (1884), Guyon (1888), Rouchaud (1888), Watson (1888), Vignard (1890), Moullin (1894), Poncet and Delore (1899), Freyer (1901), Petit (1902), Socin and Burckhardt (1902), and Proust (1903). Of these, I desire to express my special indebtedness to those by Hodgson, Thompson, Moullin, Socin and Burckhardt, and Proust. To the encyclopædic character of the monograph of Socin and Burckhardt, the bibliography of which contains over two thousand references, I am under great obligations. Besides these monographs, innumerable shorter articles have been published, to enumerate even a small part of which would be utterly impracticable in a book of this kind. In the bibliography which is appended to this work will be found references only to those authors who have been quoted by name in its pages, or who have been consulted in its preparation. The original has been consulted in every case in which it was accessible, and where it has

not been, pains have been taken to indicate the medium of information.   It is hoped that the list may prove of service to those students of the subject who wish to refer to its literature in greater detail.

CHAPTER II.

EMBRYOLOGY; COMPARATIVE ANATOMY; GROSS AND MICROSCOPICAL ANATOMY; RELATIONAL OR APPLIED ANATOMY; AND PHYSIOLOGY.

Embryology.—Although the ovary and testicle can be distinguished microscopically about the ninth week, the prostate gland is not recognizable until the third month of intrauterine life. It will be convenient, therefore, to briefly review the developement of the genito-urinary organs from this date.

It will be recalled that the genito-urinary tract is developed from three main sources—the Wolffian bodies and ducts, the Müllerian ducts, and the allantois. This last structure, which is the earliest of the three to be formed, juts forth in the second week from the primitive gut near its posterior extremity, developes forwards and protrudes at the umbilicus, forming a reservoir for waste materials. In the third week the Wolffian bodies appear, one on each side of the body cavity, as a series of tubules, caudal to the region of the heart, and lying approximately at right angles to the Wolffian ducts, and in the long axis of the body cavity. The Müllerian ducts, one on each side, appear about the fifth week, and lie parallel to the Wolffian ducts. Both pairs of ducts empty into the portion of the allantois closest to the gut. In the sixth week one can see that the allantois has expanded slightly between its point of departure from the body cavity at the umbilicus, and the point at which it receives the two pairs of ducts—Wolffian and Müllerian. This expanded part of the allantoic tube forms the future urinary bladder; and growing out from it, practically parallel with the two pairs

PLATE VI.
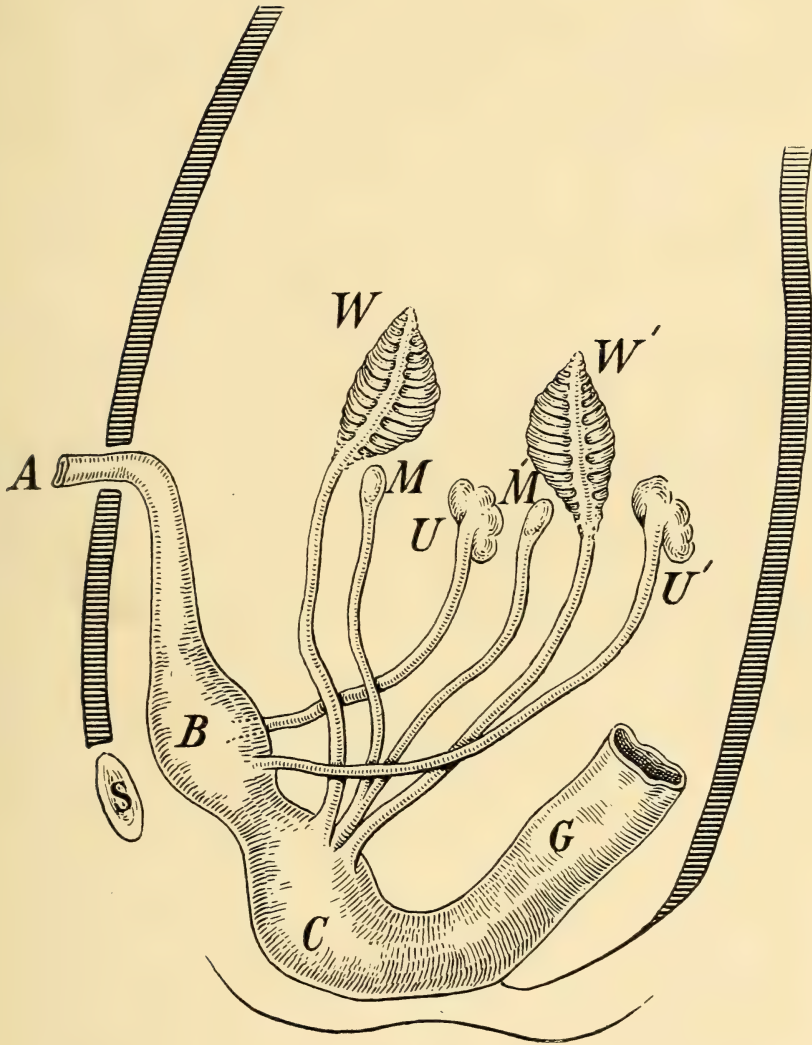
DEVELOPEMENT OF THE GENITO-URINARY TRACT (DIAGRAMMATIC).

Body wall. *A.* Allantoic stalk at umbilicus. *B.* Urinary bladder. *C.* Cloaca. *G.* Primitive gut. *S.* Symphysis pubis. *M, M'.* Müllerian ducts. *W, W'.* Wolffian bodies and ducts. *U, U'.* Ureters with kidneys attached.

of ducts, is now observed a third pair of tubes, these being the ureters. The altered portion of the allantois into which the Müllerian and Wolffian ducts empty is known as the urogenital sinus. That portion of the allantois between the urogenital sinus and the bladder later constitutes the urethra, as seen in the female. In the male this original urethra becomes subsequently greatly lengthened by the developement of the penile portion by an infolding of the skin along the lower border of the penis.

As is well known, the Wolffian ducts persist in the male and form the vasa deferentia; while in the female the Müllerian ducts persist, coalescing in their lower portions to form the uterus and vagina, but in the upper part remaining distinct, and constituting the Fallopian tubes. In the male, although these Müllerian ducts in great part disappear, yet their lower coalesced extremity persists, and is found in the adult as a little diverticulum from the prostatic urethra, known as the uterus masculinus.

As mentioned above, the prostate gland is first discoverable in the third month of fœtal life, and it can then be recognized as a thickening of the posterior wall of the urethra. Thus the analogue of the prostate gland must be sought in the female, not around the uterus, but, as Sir James Y. Simpson [211] says, "in the follicular glands and structures that exist so abundantly in the course, and at the extremity, of the female urethra"; and Hodgson [122] quotes Leuckhart as stating that in women there exists a true rudimentary prostate, consisting principally of mucous follicles and situated between the beginning of the urethra and the reflection of the vagina. He further states that Virchow admitted the existence of this body, and had often found at the neck of the bladder, especially in old women, when the internal orifice is thickened, round grayish-yellow enlargements in which there are gradually formed firm dark-coloured bodies lying embedded in the mucous membrane. These bodies Virchow con-

sidered identical with or analogous to the concretions found
in the prostatic portion of the urethra.   Guthrie [107], writing
in 1834, had no doubt that females possessed a prostate.

Most observers have held that while the glandular portion
of the prostate originates thus from the urethra, yet that the
stroma of the organ developes from a thickening of the genital
chord—which is the name given to the connective tissue containing
the Wolffian and Müllerian ducts.   But Griffiths [103, 104],
who studied the developement of the prostate in considerable
detail, taught that no part of the prostate arose from the genital
chord.   W. G. Richardson [199] from his more recent studies
is of the same opinion.   Griffiths [104] described the course
of events as follows: The normal tubular glands of the ure-
thra on its posterior surface, especially on each side of the
verumontanum, grow outward, backward, and finally turn and
come forward, so as to enclose the sides of the urethra, and at
last coalesce again on its anterior (superior) surface.   During
their growth these glands project into and between the muscular
fasciculi of the thickened posterior half of the external circular
non-striped muscle coat of the urethra in this situation.   This
external circular layer of muscle is the continuation of the cir-
cular coat of the bladder, the bladder's external muscle-coat,
which is longitudinal, ceasing at and being inserted at or near
the vesical orifice of the urethra.

Naturally, therefore, we find that in the adult the prostate
surrounds the uterus masculinus, being anatomically merely a
compound tubular developement of the urethral glands on the
two sides of this rudimentary structure.   (Compare the genitalia
of the goat, Plate IX.)

As the fœtus continues to develope it is found that the Wolf-
fian ducts (vasa deferentia) empty into the urethra upon or
even within the margins of the coalesced Müllerian ducts (uterus
masculinus); while the orifices of the prostatic (highly developed
urethral) glands retain their original situation on each side of

PLATE VII.

FŒTAL PROSTATE, WITH LOWER HALF OF BLADDER ATTACHED.
Natural size, and ten times natural size. (From a six months' fœtus in the Museum of
the German Hospital.)

the opening of the uterus masculinus. Thus is explained the apparent passage through the prostate of the ejaculatory ducts of the vasa deferentia.

The two lobes remain distinct until about the fifth month of intrauterine life, when they coalesce about the urethra. Even at birth the prostate can be recognized as a bilobed organ, lying almost entirely behind the urethra. In rare instances the urethra has been found in the adult to merely groove the anterior surface of the prostate, and not to be completely encircled by it, as is usually the case.

In connection with the embryology of the prostate a few words must be said in reference to the so-called "third lobe."

From the account of its developement just given it is seen that the prostate is really a paired organ, arising in two distinct places from the urogenital sinus, much as the ureters do from the bladder; and when the gross anatomy of the organ is studied it will be seen that the bilobed condition persists with more or less distinctness throughout life. From the day of its discovery the prostate was constantly referred to as the "glandulæ prostatæ" —the "prostate glands," showing that it was considered as a multiple organ, composed of numerous glands; and its bilobed state in fœtal life was well known. It was not until about one hundred years ago that Sir Everard Home [123] took credit to himself for discovering a third lobe, although both John Hunter [128] and Morgagni [166, 167] had recognized a pathological enlargement of this part of the organ a number of years before. Home's observations passed practically unchallenged among English surgeons, and enlargement of the third lobe became the most popular pathological change to which the prostate gland was subject. In France, however, surgeons were not so ready to acknowledge so important a discovery, as it seemed, by a foreign author; and they rather grudgingly denominated this portion of the prostate the third or median "part," being unwilling to accord it the dignity of a distinct lobe.

Sir Henry Thompson [224], writing in 1858, opened the controversy anew by pointing out both that Home's observations were not numerous, and that he had not found his third lobe in every case. Sir Henry therefore came to the conclusion that this middle lobe was merely a pathological formation, and did not normally exist at all. Griffiths [103] in his studies, observed in the greater proportion of specimens examined by him, that posterior to the verumontanum, as well as on its two lateral aspects, orifices of gland ducts could be seen,* and that pressure on the corresponding portion of the gland squeezed out prostatic secretion from glandular tissue which he found lay between the urethra and the ejaculatory ducts. His conclusion was that a third or median lobe sometimes existed, but that it was not constant; and that where it was congenitally absent, it could, of course, never become the seat of enlargement.

Such a collection of gland tubes might well be called an accessory lobe. Thorel [226] has described such accessory prostatic glands in the human subject, lying between the ureters, in the submucous tissue of the bladder; some such accessory glands are believed to exist in some of the lower animals; and since in the immense majority of cases, if not in all those carefully examined in recent years, a median projection has been found to take its origin by a pedicle from one or the other of the two lateral lobes, it is probably safe to conclude that a median or third lobe does not normally exist. There is, moreover, nothing to prevent us from thinking, in the cases described by Home and by Griffiths, that the glandular structure they found posterior to the urethra and above the ejaculatory ducts was as much separated into two lobes as that beneath the urethra and on both sides of, or anterior to, the ejaculatory ducts.

A further embryological fact of importance is the formation of a bursa between the prostate and the rectum, by the oblitera-

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*This position of the ducts from the third lobe was distinctly described by Home [123], with whose original paper Dr. Griffiths does not appear to have been familiar.

PLATE VIII.
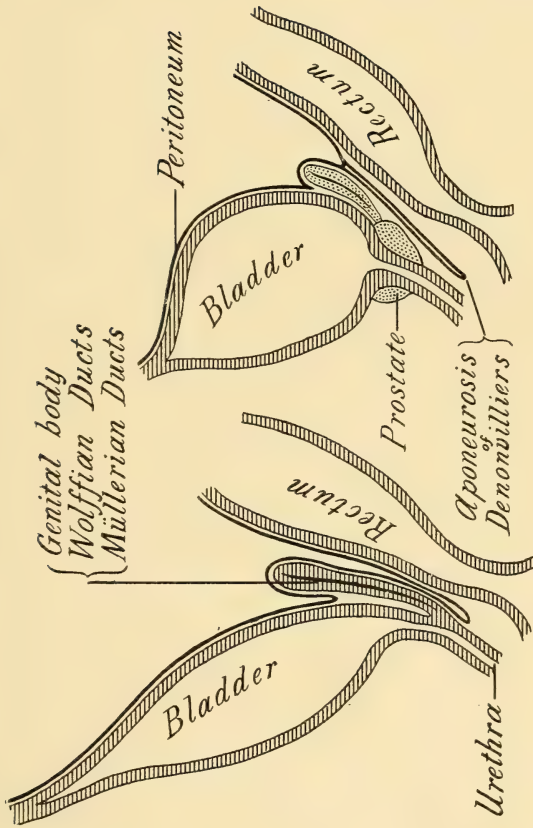
DEVELOPEMENT OF THE APONEUROSIS OF DENONVILLIERS.—(*Cunéo and Veau.*)

tion of the upper end of a serous process extending downward from the peritoneum, much as the tunica vaginalis testis is formed. This closed serous cavity between the prostate and the rectum has been recently studied by Cunéo and Veau [55], and is widely known by the name "aponeurosis of Denonvilliers." In the adult, though separable into two layers, these processes of serous tissue no longer enclose a distinct cavity.

Comparative Anatomy.—All mammals possess a prostate, but there is in birds, according to Stricker [218], no analogous organ. In certain of the batrachians he states that the pelvic and anal glands swell up during the procreative season, and discharge their secretion into the cloaca; these glands are supposed to represent the prostate and glands of Cowper. In fishes there are aggregations of acini that communicate with the vas deferens through ducts. Owen [184] states that insects have three pairs of prostates.

Although all mammals are endowed with a prostate, yet it is by no means identical in form in all. In some mammals the prostate developes around the lower extremity of the Wolffian ducts, and when fully developed retains its close relation to the vasa deferentia, but as two distinct glands, and is not, as in the human adult, applied around the first portion of the urethra embracing the ejaculatory ducts only incidentally. Moullin [176] states that even in man the situation of the prostate was probably originally around the Wolffian ducts, but that its place has become shifted in the course of racial developement. In the bull, the buck, and other of the ruminants, indeed in almost all the forms of mammalian life below the human, including the monkey, the prostate continues throughout life a bifid gland. The close resemblance which it bears in some of these animals to the seminal vesicles may account both for the ignorance of the ancients respecting the existence of the human prostate gland, and for the habit of the earliest of the modern anatomists of referring to it as the "glandulæ prostatæ."

W. G. Richardson [199, p. 35] has recently called attention
to the location of the accessory glands of generation—the pros-
tates, the seminal vesicles, and the Cowperian glands—in various
animals. He finds that the seminal vesicles are constantly in
relation with that part of the genital tract developed from the
Wolffian ducts, that the prostates are placed next, in relation
with that part developed from the urogenital sinus, while the
glands of Cowper are furthest away from the testicles, in rela-
tion with the bulbous urethra. This same general arrangement
exists in the human being, the glands of Cowper discharging
their secretion into the bulbous urethra, the prostate glands into
the prostatic urethra, and the seminal vesicles pouring their
secretion into the vasa deferentia before these latter have joined
the urethra. In the lower animals the accessory genital glands
differ much in relative size and importance, all three sets not
always being present. In the civet cat, for example, Cowper's
glands are exceptionally large, apparently to compensate for the
entire absence of the seminal vesicles; while in the guinea-pig
the seminal vesicles are of immense size, and the glands of Cow-
per very insignificant in comparison. In the squirrel, on the
other hand, the Cowperian glands are very large, and the seminal
vesicles are small.

The genitalia of the goat (Plate IX) approach most nearly
to the primitive or indifferent sexual type. Here the Müllerian
ducts persist throughout their length, as well as the Wolffian
ducts, and we have the unusual sight of the uterus masculinus
extending as a bifid organ from the urethra to the epididymis.
Nor do the lower ends of these persistent Müllerian ducts pierce
the prostate to empty into the urethra; on the contrary, the
prostate glands, one on each side of the urinary channel, are
far removed from the situation of the uterus masculinus, being
much nearer the bulbous urethra. This satisfactorily disproves
the theory formerly held by some that the male prostate gland
was the homologue of the female womb.

PLATE IX.
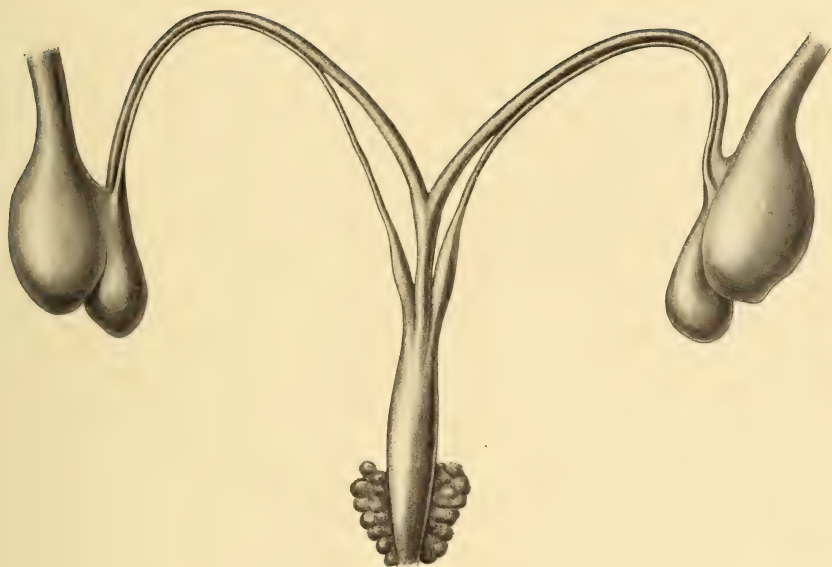
TESTES, PROSTATES AND PROTOMETRA OF THE GOAT.

Below are seen the prostates. Between the vasa deferentia is seen the uterus masculinus, which is bifid; its two horns diverge and continue, closely applied to the vasa deferentia, as far as the epididymis of each side.—(*After Owen.*)

PLATE X.

ACCESSORY MALE GLANDS AND PROTOMETRA OF HYÆNA STRIATA.

Above is seen the bladder. Emptying into the prostatic urethra are the vasa deferentia on each side of the minute uterus masculinus (protometra). The prostate glands are large, somewhat kidney-shaped bodies, in no way connected with the uterus masculinus. Emptying into the penile urethra below are seen the immense glands of Cowper. Natural size.—(*After Owen.*)

In the hyena the genitalia (Plate x) approach more nearly the human in type, but conclusively show that there is no necessary connection between the uterus masculinus and the prostate. The Cowperian glands of the hyena are of extraordinary size.

In mammals who have a rutting season the prostate gland enlarges noticeably at this period, and at its close again diminishes to its former size. John Hunter [128] studied the prostate gland in moles, and found that while it was small and insignificant during winter—the period of quiescence—yet that in the rutting season it became very large and was filled with mucus. His observations have been confirmed by Owen [185] and by Griffiths [104]. The last-named author also studied the prostates of hedgehogs, and found them to have the same characteristics.

Such observations as these, taken together with the facts that castration in animals has long been known to produce a certain amount of prostatic atrophy; that failure of developement of one vas deferens has usually been found associated with a prostate which is small and ill-formed on the affected side (see Plate xi); and the theory of "displacement" in the course of racial developement, adopted by Mr. Mansell Moullin [176] on the authority of Schäfer; leave no reasonable doubt that the prostate is physiologically a part of the genital and not of the urinary apparatus.

This idea may be further strengthened by a consideration of the ornithorhyncus, or duck-mole. In this animal, a small oviparous mammal of Australia, the urine is discharged through the cloaca, in common with the fæcal matters, as is the case in birds; and the penis with its contained urethra serves solely and entirely for the transmission of the semen and the fluids from the accessory generative glands. And although, unfortunately for the complete proof of our theory, this interesting animal is not endowed with a prostate, yet it is clear that were a prostate present, its secretion would be discharged along with

that coming from Cowper's glands, which, as well as the lower
ends of the vasa deferentia, are considerably enlarged. No
seminal vesicles are present either, but the enlargement of the
lower ends of the vasa deferentia is evidently to compensate for
this lack.

In connection with the comparative anatomy of the prostate,
a few words in relation to its comparative pathology will not be
out of place.

It is well known that of all animals the dog is most prone
to prostatic enlargement. According to Ciechanowski [50], it
is also the only domestic animal which suffers from an infec-
tious urethritis. From this fact he draws an argument in favour
of his theory that all prostatic overgrowth is due to an inflam-
matory change.

In other animals castration invariably causes prostatic
atrophy; whereas in dogs it frequently fails to have any effect,
although it was until recently about the only method of treatment
applicable for their relief. Perineal prostatectomy has also been
employed; and Loumeau [146] states that a veterinary surgeon,
a friend of his, had employed ten times successfully an operation
precisely similar to Freyer's suprapubic prostatectomy, before
learning from Loumeau that the same operation had been prac-
tised upon man.

Gross Anatomy.—The shape of the prostate is approxi-
mately that of a truncated cone, and has often been compared
to a Spanish chestnut or a horse-chestnut, having its apex down
and forward, and its base beneath the urinary bladder. In size
this gland is normally about one and a half inches (four centi-
metres) from base to apex, a little longer in transverse diameter,
and from three-fourths to one inch (two to two and a half centi-
metres) in depth or height. Its weight varies from four to six
drachms (fifteen to twenty-four grammes).

The prostate consists of glandular acini and ducts embedded
in involuntary muscle; the latter, supported by fibrous tissue,
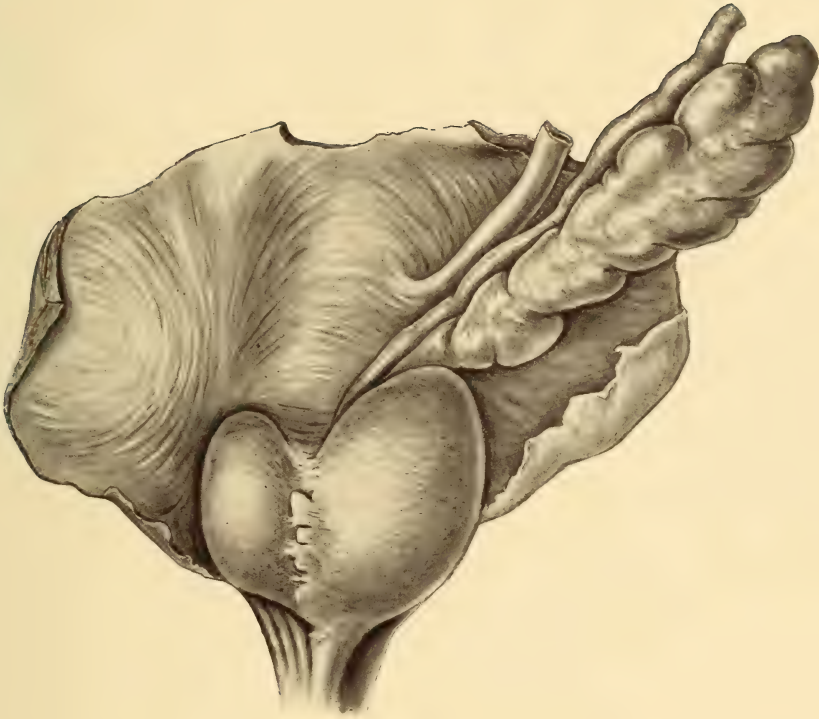
PLATE XI.

Congenital Absence of the Left Vas Deferens and Seminal Vesicle, Associated with Imperfect Developement of the Prostate on the Side Affected.—(*Socin, after Launois.*)

PLATE XII.
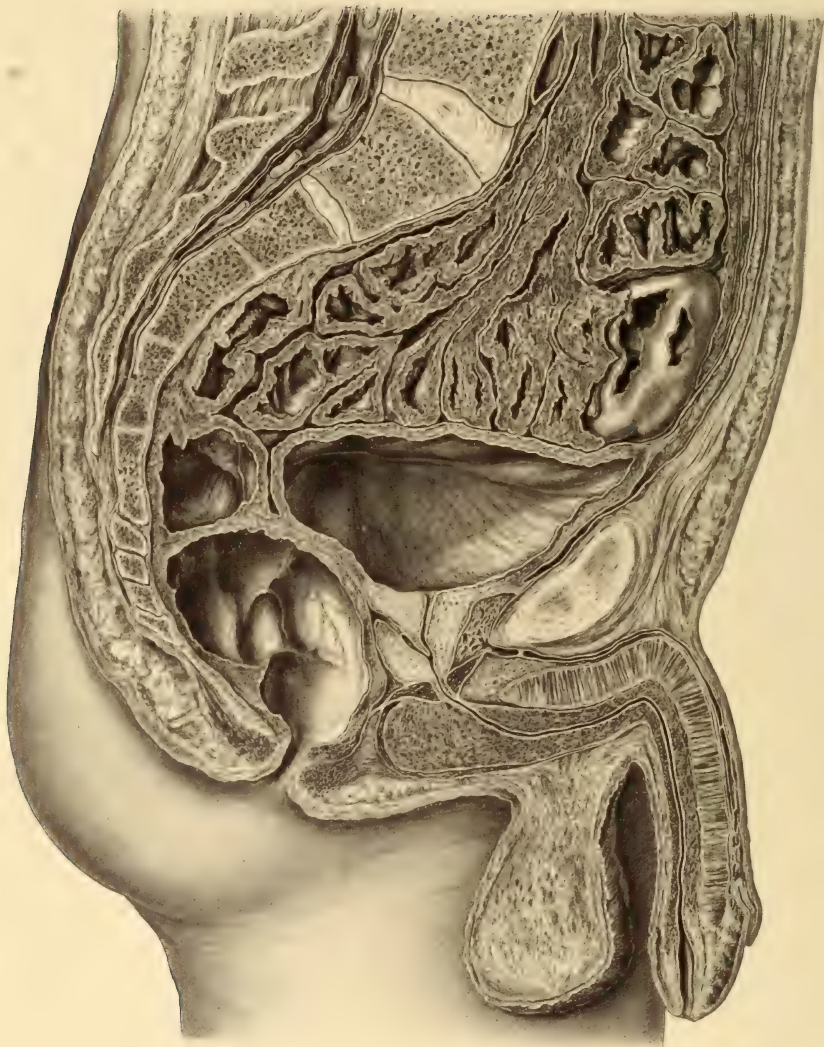
MEDIAN SAGITTAL SECTION OF THE LOWER ABDOMEN AND PELVIS, SHOWING THE GEN-
ERAL RELATIONS OF THE PROSTATE TO THE BLADDER, THE URETHRA, AND THE
RECTUM.

constituting the stroma of the organ. This stroma forms by a peripheral condensation a capsule for the gland, which is distinct from its sheath, this latter being derived from the pelvic fascia. The stroma constitutes more than half of the bulk of the organ, the remaining portion being composed of glandular tissue.

Piercing the prostate from base to apex, a little anterior to its central axis, runs the urethra, whose first part, extending from the vesical orifice behind to the deep layer of the triangular ligament in front, is called "the prostatic urethra."

Emptying into the floor of the prostatic urethra, and consequently coursing through the posterior portion of the prostate gland, are found the ejaculatory ducts of the vasa deferentia and seminal vesicles. One of these ducts empties on each side of a small diverticulum, known as the uterus masculinus, extending backward from the floor of the prostatic urethra into the substance of the prostate gland. At times the ejaculatory ducts empty within the margins of the uterus masculinus.

The uterus masculinus has its axis obliquely directed to that of the prostatic urethra, though lying in the middle line, and its cavity looks forward, so that a small catheter or sound passed along the floor of the urethra may catch in its orifice. The upper wall of the uterus masculinus causes, just back of its orifice, a prominence in the floor of the prostatic urethra; and this prominence is termed the caput gallinaginis or verumontanum. A transverse section, therefore, about the middle of the prostatic urethra is crescent-shaped, with the convexity upward. On each side of the caput gallinaginis are found the orifices of the ducts coming from the prostatic acini. Those depressed portions of the urethra on each side of the caput gallinaginis, into which these ducts empty, are known as the prostatic sinuses. The ducts may readily be demonstrated by compressing the gland, when some of the contained fluid will be seen oozing out from these orifices. The number of prostatic ducts probably varies within wide limits, being usually from fifteen to twenty.

Any glandular tissue which may exist anterior to the urethra empties through ducts in the lateral walls of the urethra; and where glandular acini exist in that portion of the organ popularly known as the middle lobe (above the ejaculatory ducts, and below the urethra), their ducts discharge their contents into the floor of the prostatic urethra just posterior to the caput gallinaginis.

The prostate gland is formed by the coalescence of two lobes around the urethra. The lobes grow from behind forwards, and accordingly the exact depth in the gland at which the urethra is found depends somewhat upon the extent of the growth. In some instances the urethra has been found merely grooving the anterior or upper surface of the prostate; but in the majority of cases it is situated with one-third of the organ in front and two-thirds back of it. The developement as a paired organ is evidenced in the healthy adult gland by a slight longitudinal furrow along both the inferior and superior surfaces of the gland. On the inferior surface there is also a transverse cleft, serving for the passage forward to the urethra of the ejaculatory ducts. The inferior surface is rather flat, and rests upon the rectum. The superior surface is more convex, and is placed about three-fourths of an inch or less behind the lower part of the symphysis pubis. The base rests against the neck of the bladder, and the apex is in contact with the deep layer of the triangular ligament of the perineum. The axis of the prostate makes an angle of about forty-five degrees with the horizon, when the individual is in the erect posture.

Sheath of the Prostate.—Tracing the transversalis or pelvic fascia down along the sides of the pelvis, we come to the white line of origin of the levator ani muscle, which stretches from the neighbourhood of the pubic symphysis in front to the spine of the ischium behind. At this white line the pelvic fascia divides into two sheets, the inferior or external (called the obturator fascia), passing between the obturator internus and the levator

PLATE XIII.

Ejaculatory duct
Recto-vesical fascia
Obturator int.
Pubic bone

Urethra

Bladder
Prostate
Rectum
LevatorAni

Ischium
Gluteus maximus
Obturator fascia
Int. Pudic vessels & nerve

Anus

Anal fascia
Ischio-rectal fossa
Ext. Sphincter Ani
Int. Sphincter Ani
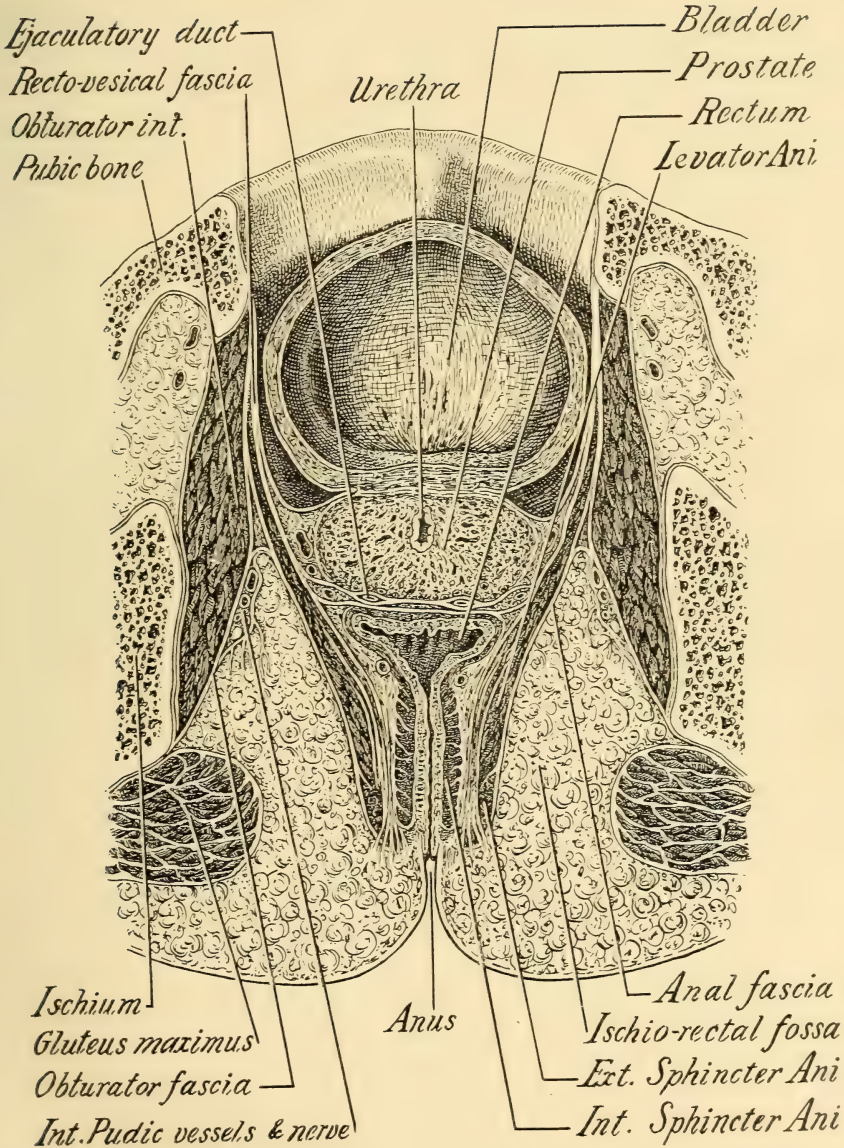
TRANSVERSE SECTION OF PELVIS, SHOWING THE GENERAL RELATIONS OF THE PROSTATE
TO THE PELVIC WALLS. LOOKING FORWARD TOWARDS THE SYMPHYSIS PUBIS.
The plane of section is nearly horizontal with the subject in the erect posture. Compare
Plate XVI.

ani, and later giving off two processes—one, on the outer wall of the ischiorectal fossa, encircling the internal pudic vessels and nerve; while the inner layer covers the inferior or external surface of the levator ani, and is called the anal fascia. The second original division of the pelvic fascia, called the recto-vesical fascia, arising at the white line, passes over the superior or internal surface of the levator ani muscle, and subdivides into three layers: (1) The superior layer passes along toward the median line, above the prostatic plexus of veins, and over the upper surface of the prostate, and coalesces with the external coat of the bladder. (2) The middle layer of the recto-vesical fascia passes below the prostatic plexus of veins, beneath the prostate and bladder, and above the rectum, and joins with its fellow of the opposite side. (3) The third and last layer of the recto-vesical fascia hugs the superior or internal surface of the levator ani, and blends with the outer coat of the rectum. The two layers last described form together the aponeurosis of Denon-villiers [62], which lies between the prostate above and the rectum below, and is really a serous sac originally derived from the peritoneum (see page 25), although more conveniently described here as part of the recto-vesical fascia.

These three layers of the recto-vesical fascia are distinguishable only at the sides of and below the prostate. Toward the median line above they are not separate, but form the pubo-prostatic ligaments, intervening between the most anterior fibres of the levator ani muscle (levator prostatæ of Santorini [204]) and the space of Retzius, and blending at the median line, between these muscular fibres (where they contain the dorsal vein of the penis), with the fascia on the outer side of these muscles—the deep layer of the triangular ligament of the perineum, which is itself a prolongation of the obturator fascia.

Between this sheath of the prostate and its capsule various fibrous prolongations pass, surrounding the venous plexus in a mesh, and binding the prostate in place. Above the prostate

these fibrous prolongations form a more or less firm septum, separating the pericapsular space around one lateral lobe from that about the other, and serving as well as a medium of support. In cases of long-standing prostatitis and periprostatitis the strength of these fibrous partitions extending among the venous plexus becomes much increased, and great force may be necessary to tear the prostate out of its enveloping sheath.

Thus it is seen that the prostate is enclosed more or less concentrically first in its own capsule; then within its venous plexus at the sides and anteriorly, and by the bladder above; and, finally, outside of the venous plexus again, passes the sheath of the prostate.

The Prostatic Plexus.—The dorsal vein of the penis passes beneath the subpubic ligament, being provided just before its passage with valves, sometimes three in number; and then divides into two branches which clothe the sides of the prostate. Here it is joined by veins from the substance of the prostate, and by other minor tributaries, forming the venous plexus of Santorini [205]. No tributaries, however, come from the parietal veins of the pelvis. This plexus lies chiefly on the anterior and lateral aspects of the prostate, and its veins, like others in the pelvis, and in spite of the large number of valves present, are prone to become engorged. In the aged they frequently become varicose, and the formation of phleboliths is not at all uncommon.

This plexus lies within the meshes of the sheath of the prostate, entirely outside of its capsule. Its veins travel backward, receiving veins from the sides and base of the bladder, and from the cellular tissue about the rectum, and finally empty into the internal iliac veins. Fenwick [76] has shown that this important plexus has three distinct sets of valves, which all tend to prevent backward pressure. One set is found at the commencement of the system; one at the end, in the internal iliac veins; and a third set, which is less constant, about the middle of the plexus.

Practically all the veins which enter this plexus are valved, so that Fenwick compares the condition to that of a series of rooms with many different entrances, but only one exit, the result being that the direction of the current is normally always straight onward. The branches received from the internal pudic veins and from the perirectal veins are powerfully valved, so that normally no regurgitation into the hæmorrhoidal circulation can take place.

The Arteries.—The arteries of the prostate are numerous but insignificant. They arise from the internal pudic, inferior vesical, and middle hæmorrhoidal arteries. The largest is the vesico-prostatic artery, derived from the inferior vesical, passing along on the lower part of the sides of the bladder to the prostate. The twigs given off from this artery on the surface of the prostate in part supply its substance, piercing its capsule, and in part anastomose with twigs from the corresponding artery on the opposite side, above the prostate. There are seldom many communicating branches below the gland, while the branches from the internal pudic and middle hæmorrhoidal are rarely of sufficient size to be noticed.

Sometimes the internal pudic artery is smaller than usual, and its terminal branches are then derived from the vesico-prostatic, or from an accessory pudic artery, rising from the internal pudic artery just before its passage through the great sacro-sciatic foramen. When they are derived from the accessory pudic, they may be wounded in operations on the perineum; but when springing from the vesico-prostatic, they lie above the prostate and urethra, and are not so liable to injury.

The Nerves.—The nerves are largely derived from the sympathetic system through the pelvic or inferior hypogastric plexus, some medullated fibres being found also. These last are derived chiefly from the third sacral nerve, but also to some extent from the second and fourth. The nerves accompany the arteries, lying between the prostate and the levatores ani in their forward

4 P

course.   The bladder, the urethra, and the cavernous tissue of
the penis receive their nerve-supply from the same source; and
thus the reflex pains felt at the end of the penis, in certain affec-
tions of the bladder, are readily accounted for.

The Lymphatics.—The lymphatics are both deep and super-
ficial.   The former accompany the smaller vessels in the stroma
of the gland, while the superficial series lies with the venous
plexus between the prostatic capsule and its sheath.   These are
eventually joined by the deep vessels, and they together empty
into the lymphatics along the course of the internal iliac vessels.

Microscopical Anatomy.—Histologically the prostate is
classed as a compound tubular gland.   The acini are embedded
in a meshwork of involuntary muscle and fibrous tissue, this latter
extending as septa inward from the prostatic capsule, which is
formed by a peripheral condensation of the stroma of the organ.
Among the muscular and fibrous tissues and around the acini
are found the arterial twigs, the venous radicles, and the deep
set of lymphatic vessels.   The ultimate distribution of the nerves
is not definitely known.

The glandular tissue is most marked in the two lateral lobes
of the prostate beneath the urethra, and is in greater evidence
toward the apex than the base of the organ.   In the portion
of the prostate anterior to the urethra there is little glandular
tissue; this part as well as that immediately beneath the urethra
representing the areas of coalescence or the commissures of the
two lateral lobes, and being almost wholly composed of muscular
and fibrous tissue.   Sometimes gland tubules are found below
the urethra and above the ejaculatory ducts, forming the so-called
third lobe of the prostate; but more usual is it for glandular tissue
to be absent in this region.

The muscular tissue of the prostate, as shown by Hodgson
[122] and by Griffiths [104], is a continuation, more or less
direct, of the circular layer of the bladder; the outer vesical
layer, which is longitudinal in direction, ceasing at the level of

the urethral orifice. This circular layer has become displaced by the growth into it of the glandular tissue, which arose from the mucous lining of the urethra; accordingly the ducts of the prostate are found to be devoid of a special muscular investment, whereas the acini have a layer of involuntary muscle surrounding them throughout their extent.

The muscular fibres of the prostate are arranged as a compact layer around its periphery, forming with the contiguous fibrous tissue the true capsule of the gland; and also circularly around the urethra, acting here as the muscularis mucosæ; while, finally, there is a poorly marked longitudinal layer of involuntary muscle just external to the urethral muscularis mucosæ. There are thus in the prostatic urethra three coats of involuntary muscle; the most internal is circular, and forms the muscularis mucosæ; the middle, poorly developed, is longitudinal, and is really a continuation of the muscles of the ureters; while dispersed throughout the gland is found an outer circular layer, which may be recognized as the circular coat of the bladder.

This description is that generally given, and most widely received. It is well to note, however, that Pettigrew [192] proposed the ingenious theory that all the fibres of the bladder are really in a figure-of-eight form, in seven layers. Of these layers, he asserted that the fibres of the central crossed so very obliquely that they appeared circular; while the fibres composing the three external and the three internal layers are of different degrees of obliquity, so that the most internal and the most external appear longitudinal. The muscle of the prostate, according to this view, is derived from the outer halves of the three external vesical layers, while the internal halves of these layers enclose the prostatic urethra immediately outside of its usually recognized muscular coats, which, Pettigrew says, are really the central and three internal layers of the bladder.

Wallace [240] asserts that striped as well as unstriped muscular fibres are found among the glandular tissue of the normal prostate.

The gland ducts are lined close to their orifices at the urethra with a prolongation of the usual transitional epithelium of this canal; deeper in they are lined by a single layer of columnar epithelium, but possess no distinct basement membrane. They often penetrate the urethral walls obliquely. In infants ducts only are found, no acini having developed.

The acini themselves are paved with columnar epithelium, which, though usually in a single layer, is frequently stratified, smaller pear-shaped or polyhedral elements filling up the crevices between the columnar cells. The nuclei of these acinous cells are placed nearer to the basement membrane than to the free end of the cells. The cells are often granular in appearance.

Walker [235] has described collections of small round cells in the prostate. These he regards as lymph nodes; but he has not succeeded in demonstrating lymph channels, except at the periphery of the gland. His observations do not appear to have been confirmed by other investigators, who regard Walker's lymph nodes as evidences of inflammation.

Elastic tissue also is found in the prostate, lying circularly around the urethra, and sending figure-of-eight processes out around the prostatic ducts, just beneath the mucous membrane.

The uterus masculinus is an oval or rounded saccule, about one-fourth or one-third of an inch in length, lined with mucous membrane containing small tubular glands homologous with those of the female womb. It possesses, moreover, a thin layer of involuntary muscle, and is contained within a dense fibrous envelope of its own. Its orifice will admit the tip of a small probe or catheter.

The prostatic urethra extends from the bladder above to the deep layer of the triangular ligament below, where it becomes the membranous urethra. Its course is at first downward, but toward the termination of the membranous portion it has commenced its upward journey, which is continued in the bulbous portion until the penile urethra is reached, when the curve again

PLATE XIV.
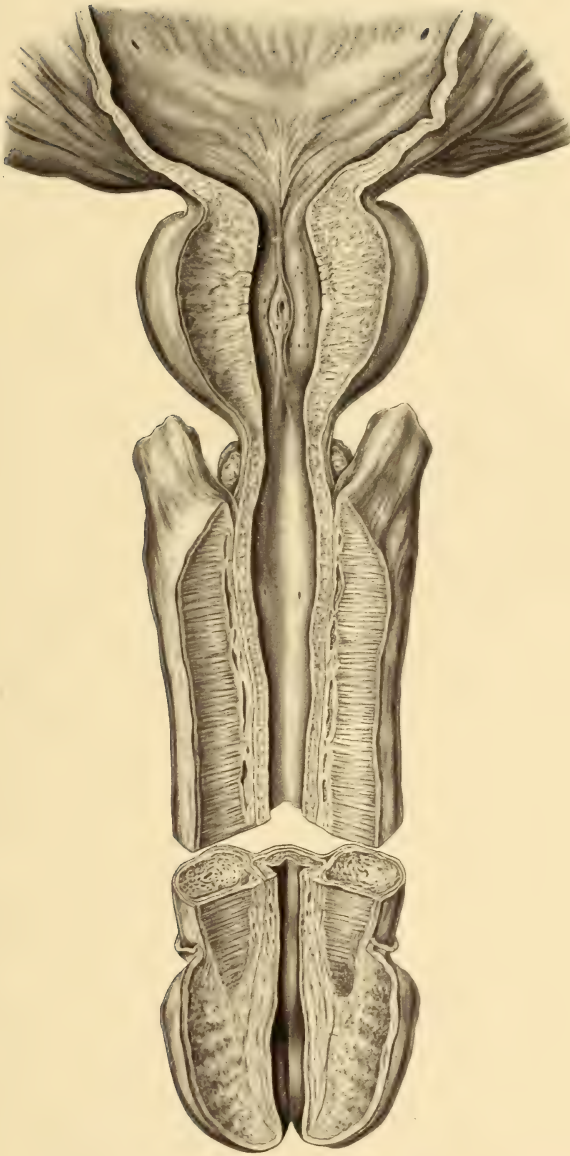
Urethra and Bladder Laid Open from Above, showing in Bulbous Urethra the Orifices of the Ducts of Cowper's Glands, and in the Prostatic Urethra the Orifice of the Uterus Masculinus, with the Openings of the Prostatic Ducts on Each Side of the Verumontanum. Note the Orifices of the Ejaculatory Ducts on the Margins of the Orifice of the Uterus Masculinus.
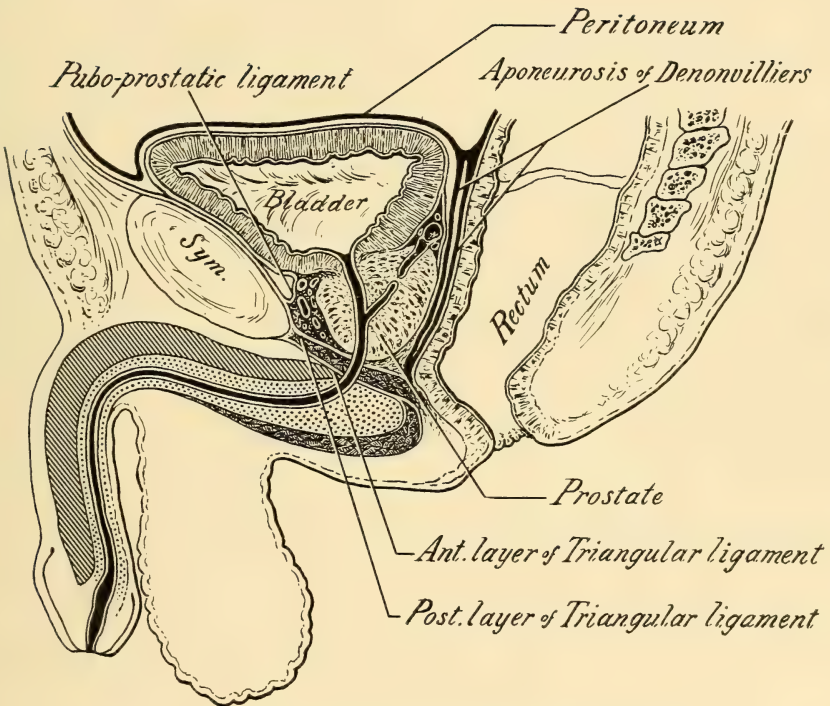
PLATE XV.

SHEATH OF PROSTATE IN SAGITTAL SECTION (DIAGRAMMATIC).

PLATE XVI.

Recto-vesical fascia
1st. Division
2nd. Division
3rd. Division

B

P

R

Obturator
Internus

Anal fascia

Levator Ani

Obturator
fascia

Int. Pudic
vessels & nerve
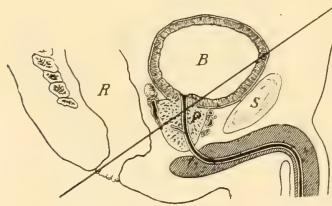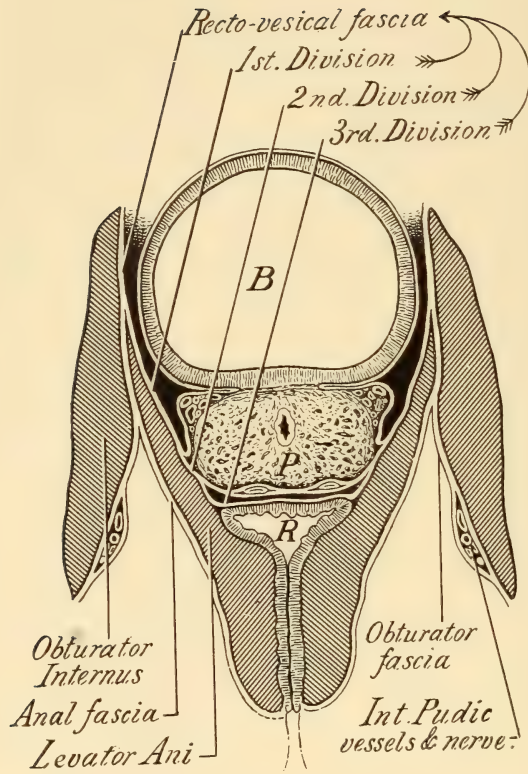
SHEATH OF PROSTATE IN TRANSVERSE SECTION. LINE OF SECTION SHOWN IN THE
LOWER DRAWING. (DIAGRAMMATIC.)
Compare with Plate XIII.

PLATE XVII.
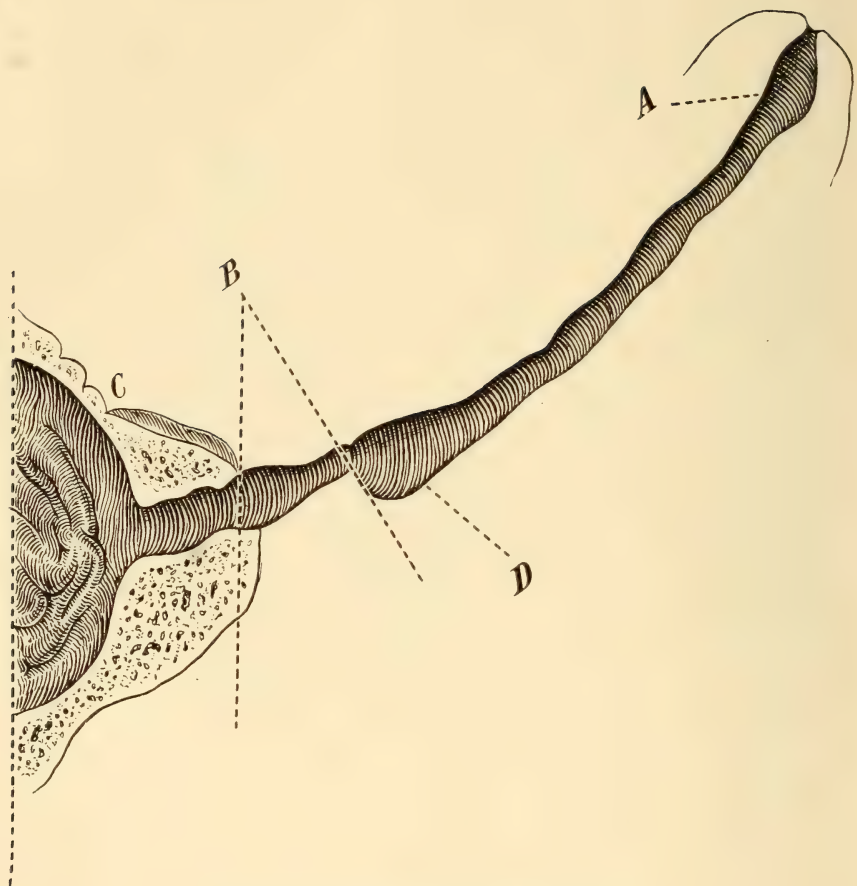
NORMAL URETHRA, SHOWING DILATABILITY.
A. Fossa navicularis.   *D.* Bulbous urethra.   *B.* Membranous urethra.   *C.* Prostatic urethra.

PLATE XVIII.
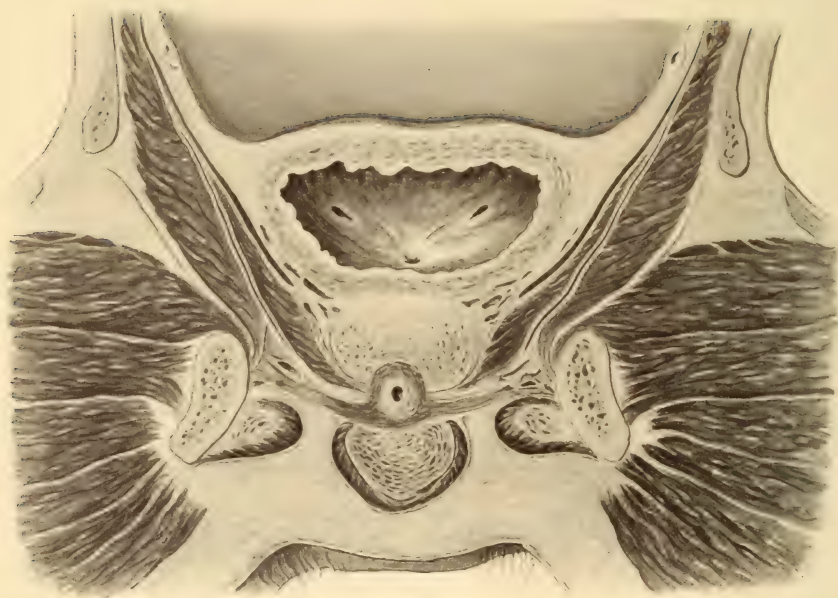
CORONAL SECTION OF THE PELVIS, THROUGH THE PROSTATE AND THE MEMBRANOUS
URETHRA, SHOWING THE TRIANGULAR LIGAMENT OF THE PERINEUM. VIEW OF
THE ANTERIOR SURFACE OF THE POSTERIOR SEGMENT OF THE PELVIS.—(*Spalte-
holz.*)

PLATE XIX.

VIEW OF THE PELVIS FROM BEHIND.

Notice the white line of origin of the levator ani; the relations of the ureters, vasa deferentia, and seminal vesicles. The prostatic sheath is well shown, also the two layers of the recto-prostatic fascia (aponeurosis of Denonvilliers), and between them the deep layer of the triangular ligament.

changes, and here has its convexity upward. The prostatic urethra is from three-fourths of an inch to an inch in length, and normally has its sides in contact. Its floor is raised by the verumontanum or caput gallinaginis so that on cross-section it presents a crescentic outline, with convexity above. Its internal diameter is about one-third of an inch (eight millimetres), but it is the most dilatable part of the whole canal. On its superior wall, just beneath the mucous membrane, are numerous good-sized veins, which, when engorged, may easily be ruptured by a catheter carelessly passed. The caput gallinaginis is partly composed of erectile tissue, which by its turgescence during sexual excitement is supposed to prevent reflux of semen into the bladder. The mucous membrane of the prostatic urethra is convoluted into longitudinal folds when no urine is passing, and is hence readily adapted to changes in calibre of this canal.

Relational or Applied Anatomy.—Although the state of the parts surrounding the prostate is of greater anatomical interest to the surgeon when altered by disease, yet a clear understanding of such pathological changes is only to be acquired by a thorough knowledge of the normal relations.

Placed in the true pelvic cavity, below the bladder, above the rectum, and about half an inch behind the lower margin of the pubic symphysis, the prostate is held quite firmly in place by the supporting fasciæ.

From the bladder it is separated only by a thin layer of fascia (the first of the three subdivisions of the recto-vesical fascia) which becomes blended with both the outer coat of the bladder and, in the middle line, with the capsule of the prostate. Hence on incising the mucous membrane of the bladder, as soon as the muscularis mucosæ is divided, this layer of fascia presents itself, forming the sheath of the prostate; and as there are in this situation no veins of any size between the prostatic sheath and its capsule, the sheath and capsule are here practically in contact. When the prostate becomes much enlarged, this layer of fascia

atrophies or is pushed to one side, and the prostatic capsule presents itself immediately beneath the vesical mucous membrane.

To the rectum the prostate is rather firmly attached by fibrous connective tissue, which may, with care, be separated into two layers, prolongations of the recto-vesical fascia; the lower layer blends with the fibrous covering of the rectum, while the upper sends processes around the seminal vesicles and ampullæ of the vasa deferentia, besides passing below the prostatic plexus of veins to join a similar layer from the other side. This layer remains after the removal of the gland by suprapubic prostatectomy, and, with that immediately subjacent, effectually prevents urinary extravasation into the perirectal and subperitoneal cellular tissues. These two layers of fascia form together the aponeurosis of Denonvilliers [62], and the rectum cannot be safely stripped back from the prostate in the operation of perineal prostatectomy until the inferior layer, which is the stronger, has been divided; by so doing the surgeon is admitted into the "éspace decollable rétroprostatique," so eloquently described by Proust [196].

The recto-vesical fascia forms in the median line anteriorly two thicker bands of fascia, known as the pubo-prostatic ligaments or anterior true ligaments of the bladder. These are attached above to the pubic bones on each side of the symphysis, and are inserted below into the capsule of the prostate on its upper surface, and into the anterior surface of the bladder. When I say inserted into the capsule of the prostate, I wish it to be understood that here, as elsewhere, the prostatic plexus of veins lies immediately outside the capsule of the prostate gland, and that the insertion above described takes place by processes of fascia sent between the veins where they are numerous, and by a coalescence of the sheath with the capsule where the veins are absent. The dorsal vein of the penis, after perforating the deep layer of the triangular ligament of the perineum, lies in the interval be-

tween the two pubo-prostatic ligaments, and as they pass on to their insertion into the bladder, it subdivides beneath them into the prostatic plexus. Because fibres of involuntary muscle, prolonged from the bladder-wall, are found beneath the pubo-prostatic ligaments, they are also called the pubo-prostatic muscles.

In the median line anteriorly the recto-vesical fascia (pubo-prostatic ligaments) is in contact beneath the pubic arch with the deep layer of the triangular ligament of the perineum (the dorsal vein of the penis intervening); but to each side of the median line these structures are separated by the most anterior fibres of the levatores ani muscles, which in this situation were denominated by Santorini [204] the levatores prostatæ. These muscular fibres descend upon the sides of the prostate, and unite beneath it; in this situation they blend with the fibres of the superficial transverse perineal and external sphincter ani muscles, forming the central tendinous point of the perineum. The deep layer of the triangular ligament, it should be remembered, is really one of the ultimate subdivisions of the pelvic fascia, being the continuation toward the median line of the obturator fascia, which lies between the levator ani and the obturator internus muscles.

The urethra emerges from the prostate gland at its apex, about half an inch below the pubic arch. It here passes through the posterior or deep layer of the triangular ligament and becomes the membranous urethra. This layer of fascia is firm and tense, and accordingly the apex of the prostate gland is its most fixed portion; enlargement of the organ necessarily extends backward, upward, or downward, never forward. There is no sharp ring where the urethra penetrates the triangular ligament, as this membrane, instead of terminating abruptly at the circumference of the urethra, is reflected along its surface toward the prostate, and blends with its fibrous coat. Thus a catheter is not liable to be arrested by any ring-like constriction outside the lumen of the urethra.

The prostatic urethra is normally about seven inches distant from the external urinary meatus.   Any obstruction seated nearer than this to the meatus is not likely to be caused by disease of the prostate.

About one and a half inches within the anus the prostate may be felt as a rounded, firm body of about the size of a horse-chestnut or a little larger.   By combined examination with a sound in the urethra and a finger in the rectum much information as to its size and shape may be obtained.

It is well known that the anterior wall of the rectum undergoes a sharp flexure just within the anus, so that the axis of the rectum is practically at right angles with that of the anus.   This angle of the anterior rectal wall is produced by its attachment to the triangular ligament of the perineum by certain muscular fibres described as the recto-urethral muscle.   The external sphincter of the anus, it will be recalled, is attached anteriorly to the perineal centre, meeting there with the superficial transverse perineal muscles from the sides, with the anterior fibres of the levatores ani muscles from a deeper plane posteriorly, and with the bulb of the urethra anteriorly.   On a plane just beneath these structures are met the recto-urethral muscle posteriorly, and the triangular ligament containing the deep transverse perineal muscles (constrictor urethræ) anteriorly.   To understand how the levator ani, which between the space of Retzius and the pubic symphysis is on a deeper plane than the triangular ligament, can become superficial to this structure and the recto-urethral muscle, it must be remembered that the levator ani is like a sling, and hangs down from the pubic bones to surround the anus, being deficient in the median line under the pubic arch, and only becoming superficial to the triangular ligament back of the posterior border of this structure, where its fibres from the two sides of the prostate unite at the perineal centre.   The accompanying illustration (Plate XXI) shows these relations very well.

PLATE XX.

SIDE VIEW OF THE PELVIS SHOWING THE FASCIÆ AROUND THE BLADDER AND PROSTATE.

A. First division of recto-vesical fascia. *B*. Ureter. *C*. Seminal vesicle. *D*. Vas deferens. *E*. Anterior layer, and *F*. posterior layer of aponeurosis of Denonvilliers (being the second and third layers of the recto-vesical fascia).—(*After Proust.*)

Plate XXI.
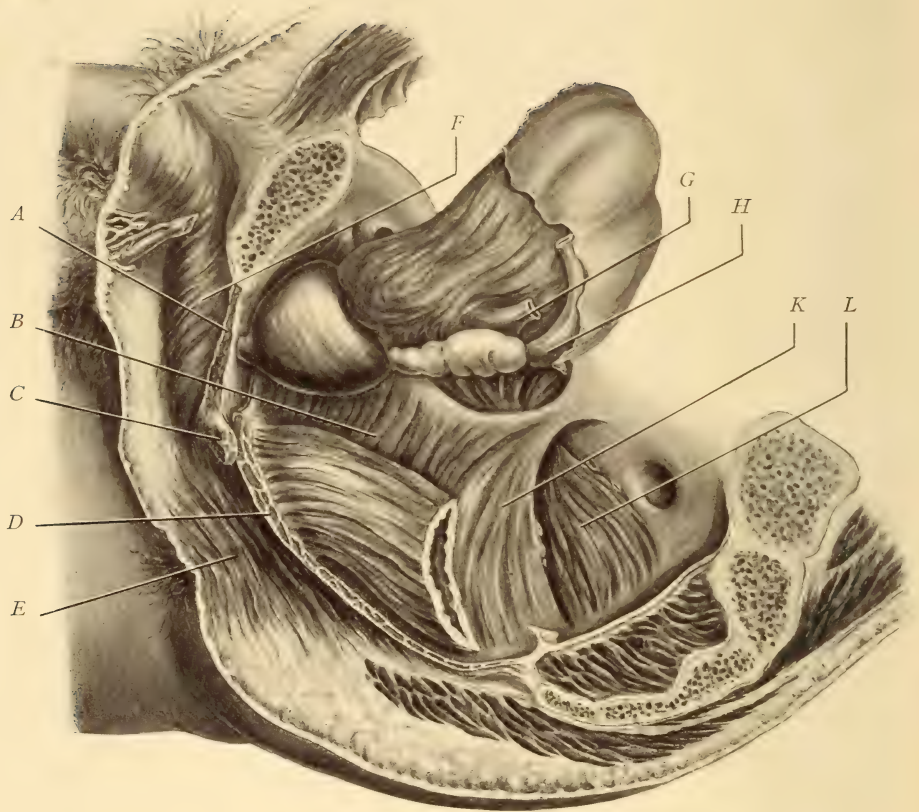
Side View of the Pelvis showing the Muscles around the Bladder and Prostate.

A. Triangular ligament. B. Levator ani muscle of right side. C. Deep transversus perinei muscle of left side. D. Cut edge of levator ani muscle of left side. E. External sphincter ani muscle. F. Bulbo-cavernosus muscle. G. Left ureter. H. Vas deferens (left). K. Coccygeus muscle (right). L. Pyriformis muscle (right). The bladder and prostate have been displaced upward so as to expose the levator ani.

The recto-vesical fold of peritoneum reaches, when the bladder is empty, as far as the base of the prostate, or nearly so; but when the bladder is distended with a moderate amount of fluid, the peritoneal reflection is probably always at least one and a half inches above the base of the prostate gland. This explains how the bladder was formerly tapped through the rectum with such success, and shows that in any ordinary operation on the prostate through the perineum no fear need be entertained of opening the peritoneal cavity.

The anterior vesical fold of peritoneum is carried up about two inches above the upper margin of the symphysis pubis by moderate distention of the bladder; but as in suprapubic operations the peritoneum is usually recognized with ease, if seen at all, and may readily be stripped off from the bladder if more room is desired, the relations here are not of such practical interest.

The ampullæ of the vasa deferentia lie between the two seminal vesicles upon the rectum, and beneath the neck of the bladder, just back of the prostate gland, where they may be felt by a finger in the rectum. The ureters lie above and on their outer side; and in the small area between the prostate anteriorly, the vasa deferentia at the sides, and the peritoneal reflection above or posteriorly, the bladder is in fairly close relation with the rectum. This is the spot where, when fluctuation could be detected, the bladder was formerly punctured for retention of urine.

The combined ejaculatory duct of the vas deferens and seminal vesicle of each side penetrates the prostate gland through a transverse fissure on its inferior surface; the two ducts then run forward, and empty side by side into the floor of the prostatic urethra. They pass through the posterior commissure of the two lateral lobes, an area composed almost entirely of fibrous and muscular tissue. According to Mr. Freyer [89], when the prostate undergoes marked adenomatous change, its two

lateral lobes tend to become again separated, as they were during
fœtal life; and hence under such conditions it is not theoretically
absurd to consider that the two lateral lobes could be shelled
off the ejaculatory ducts, leaving their attachment to the urethra
intact. That such is ever the case during life is, however, in
the highest degree improbable. Young [261] has pointed out
that in enlargement of the prostate these ducts are situated
relatively nearer the inferior surface of the prostate than in health,
and he advocates an operation by which the mass of prostatic
tissue containing them is left attached to the urethra. Since it
is probable, as will be seen in the next section, that the seminal
fluid has no fertilizing power when unmixed with that from the
prostate, and for other reasons of a less sentimental nature, it
appears to me extremely doubtful whether any attempt to pre-
serve the continuity of the ejaculatory ducts with the urethra
in operations on the prostate gland is at all advisable.

Physiology.—That the prostate gland is functionally a part
of the generative rather than of the urinary tract is evident from
the various points brought forward in connection with its embry-
ology and comparative anatomy. What its exact function is,
however, remains an undecided question. Prostatic fluid, as
long ago noted by Haller [109], Morgagni [166, 167], and Hun-
ter [128], is useful chiefly as an accessory and diluent of the tes-
ticular secretion and of the fluid derived from the seminal vesicles.
Testicular fluid is alkaline in reaction, and, as pointed out by
Adams [1], that of the prostate is acid; hence it may be inferred
that the fluid from the prostate is useful in neutralizing the
alkalinity of the testicular secretion. In perfect accord with
this reasoning are the experiments of Fürbringer [93], who showed
that spermatozoa which were motionless when no admixture
of prostatic fluid was present, were excited to action by the
addition of a moderate quantity; while the addition of larger
amounts killed them. Steinach [215], moreover, has shown that
the removal of the seminal vesicles and the prostate gland from

PLATE XXII.
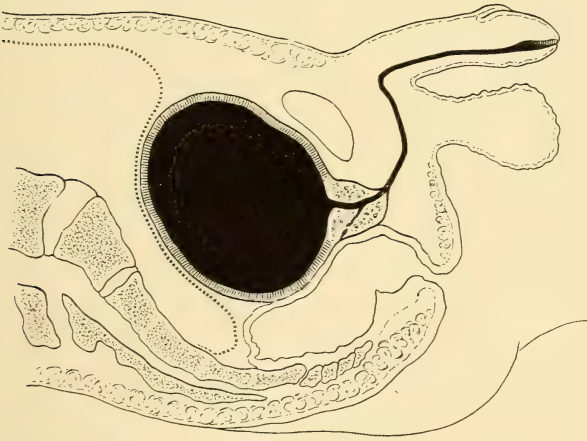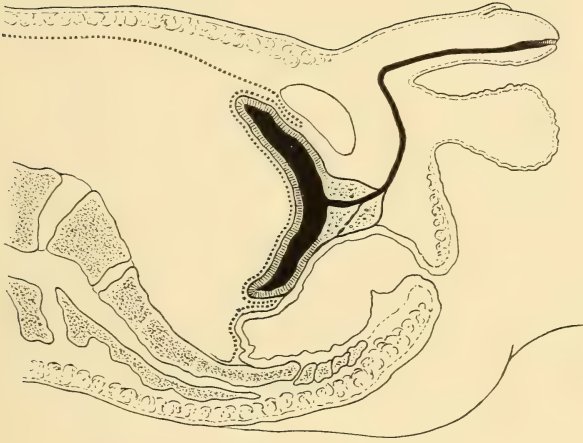
SIDE VIEW OF THE PELVIS, SHOWING THE RELATIONS OF THE PERITONEUM TO THE EMPTY AND THE DISTENDED BLADDER.—(*After Gerrish.*)

DISSECTION OF THE PERINEUM.

The attachment of the external sphincter ani to the perineal centre has been divided, and the fascia of Colles has been reflected, exposing the superficial vessels and nerves of the perineum, the superficial transverse perineal muscles, the ischio-cavernosus and the bulbo-cavernosus muscles. Posteriorly, on each side of the anus are seen the levatores ani muscles, clothing the sides of the rectum; on the subject's left the internal pudic artery and branches of the pudic nerve are seen.

PLATE XXIV.
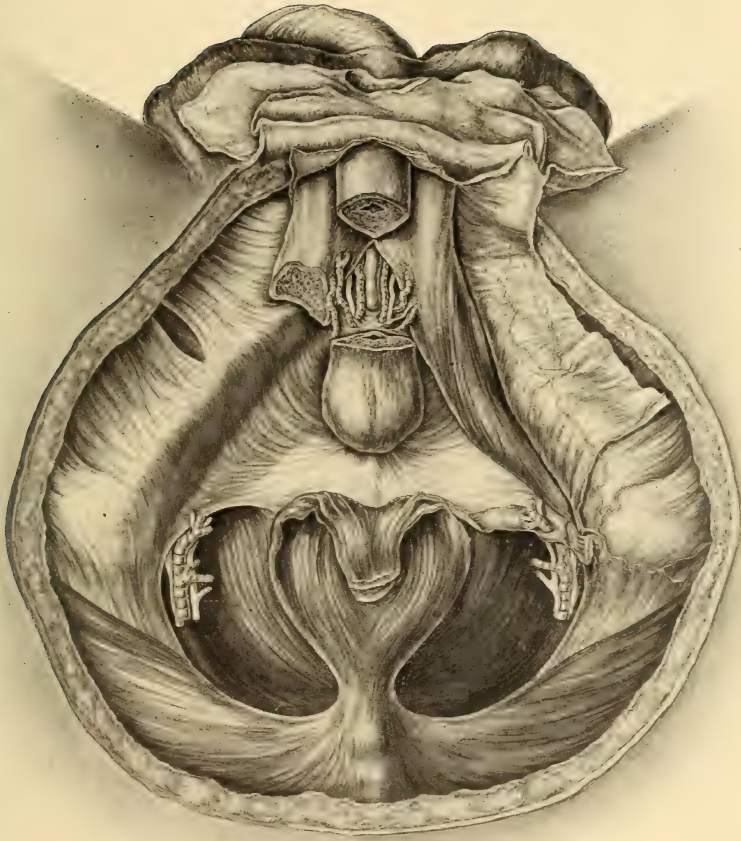
DISSECTION OF THE PERINEUM.

The superficial transverse perineal muscles, the bulbo-cavernosus muscle, and the right ischio-cavernosus muscle, have been removed, together with part of the right corpus cavernosum and a section of the corpus spongiosum and urethra. The superficial layer of the triangular ligament, the dorsal vein, artery and nerves of the penis, and the arteries of the corpus cavernosum, are thus exposed.

PLATE XXV.

DISSECTION OF THE PERINEUM.

The superficial layer of the triangular ligament has been incised, exposing the deep transversus perinei muscle on the left side, and the internal pudic vessels and nerve on the right side of the cadaver. The duct of Cowper's gland of the right side is seen as it enters the bulbous urethra, after piercing the superficial layer of the triangular ligament.

white rats, "while not diminishing the sexual passion and the ability to perform the sexual act, including the actual discharge of spermatozoa, prevents entirely the fertilization of the ova; removal of the seminal vesicles alone markedly weakens the fertilizing power of the semen."

It is not known whether the prostate furnishes an internal secretion to the body; that it furnishes one of any considerable consequence is at all events unlikely. Its removal has about as much apparent effect on the functions of the body as has that of the vermiform appendix; yet it is believed by some that the appendix furnishes an internal secretion.

Concretions are frequently found in the prostatic acini in advanced life. Their nucleus is probably mucoid material and epithelial cells; while the concentric layers of mineral matter are formed from the prostatic secretion. The amount of earthy matter in these concretions has been estimated at from 46 to 86 per cent. Prostatic fluid itself contains only about 1.5 per cent. of solids, which are mostly proteids and salts. Some of the most recent researches into the physiology of prostatic secretion are those of Stern [216], who thinks its normal reaction is alkaline, acidity being a sign of disease.

At birth and until puberty the prostate is small, and contains more muscular tissue in relation to the glandular than is the case in later life. At puberty the increase in size of the prostate is proportionate to that of the rest of the sexual apparatus; the glandular tissue at the same time developes from the mere ducts present in childhood until well-formed acini are found.

During sexual excitement the caput gallinaginis becomes turgid, and, possibly with the aid of the contraction of those fibres of the prostate nearest the bladder, shuts off this viscus from the prostatic urethra. Powerful rhythmic contraction of the prostatic muscle follows, and the prostatic fluid is forced into the urethra, to dilute and give bulk to that arriving through the ejaculatory ducts. Contraction of Henle's [120] muscle

(external sphincter of the bladder) and of the deep transverse perineal muscles (constrictor urethræ) aids in the expulsion forward.

As middle life passes and old age advances some general enlargement of the prostate gland may be considered nearly universal, so frequently does it occur. That it is not normal, however, is clear from the fact that some diminution in size occurs in all the other generative organs, as the sexual life draws to a close; much in the same way that the generative organs of those animals who have a rutting season decrease in size when that season is passed.

The prostate gland is normally quite passive during urination. Functionally the prostatic urethra is part of the bladder, whose true sphincter is the voluntary muscle placed around the membranous urethra (constrictor urethræ, or deep transverse perineal muscles), aided perhaps by those fibres of voluntary muscle known by Henle's [120] name (external sphincter of the bladder), and situated about the apex of the prostate gland just posterior to the deep layer of the triangular ligament. As urine accumulates in the bladder, the natural elasticity of the parts excludes it from the prostatic urethra. When the natural elasticity, the muscular tone of the bladder, or whatever we choose to call it, is overcome, then the urine enters the prostatic urethra, and meets with an obstruction from the voluntary muscle around the apex of the prostate (Henle's muscle) and the membranous urethra (constrictor urethræ). As Moullin [176] has pointed out, the voluntary muscles here are stronger than is the case with the anal sphincters. There the ever increasing desire to defæcate overcomes the voluntary sphincter (external); but the constrictor urethræ generally holds tight, and the involuntary muscle of the bladder gives in, and the urine is retained, until a sufficient increment of urine has collected, when the process may be repeated. When a perineal section is done for an impermeable stricture, no urine flows until the membranous urethra

PLATE XXVI.

DISSECTION OF THE PERINEUM.

The bulb of the urethra and the left deep transversus perinei muscle have been removed. On the subject's left the deep layer of the triangular ligament is exposed. On the right Cowper's gland is seen.

PLATE XXVII.

DISSECTION OF THE PERINEUM.

The deep layer of the triangular ligament, with all structures superficial to it, has been removed, exposing the perineal portion of the levator ani muscle and its anterior fibres known as the levator prostatæ. The urethra has been cut off at the apex of the prostate gland. The fibres of the levator ani passing underneath the rectum are shown as in the preceding plates.

PLATE XXVIII.

DISSECTION OF THE PERINEUM.

The recto-vesical fascia, forming the sheath of the prostate, and the levator ani muscle, have been incised from the symphysis to the anus, and the rectum has been turned backward. The prostate, the seminal vesicles, and the vasa deferentia are exposed. Note the vesico-prostatic plexus of veins in the meshes of the recto-vesical fascia. The wall of the bladder is seen above the prostate.

has been divided; it is not necessary to enter the bladder, whose cavity now, when overdistended, functionally extends as far as the triangular ligament. Likewise if a catheter is passed while the patient is straining to urinate, urine will begin to flow as soon as the prostatic urethra is reached; but if no desire to urinate is present, the catheter must be passed its full length into the bladder before urine flows. In patients with enlarged prostate who are able to make water this test provides a very simple and fairly accurate way to determine the length of the prostatic urethra.

During urination the muscles of the ureters—longitudinal bands prolonged from the ureters to the uvula vesicæ and verumontanum—contract, and by their action tend to lower the vesical orifice of the urethra and to raise the neck of the bladder, thus effectually opening the prostatic urethra, and making it bear the same relation to the bladder that the spout of a funnel does to its cone. It was a favorite theory of Mr. Reginald Harrison's [116] that the prostate aided in expelling the last drops of urine, and that the lower the neck of the bladder subsided below the urethral orifice, the harder was the work thrown on the prostate, which accordingly underwent compensatory hypertrophy in its vain endeavours to expel the residual urine. That such a theory is untenable I think is manifest from the various facts already set forth, for it is undoubtedly true that the prostate is entirely passive during micturition, and only contracts during the sexual orgasm.

CHAPTER III.

PATHOLOGY AND ÆTIOLOGY.

The subjects of pathology and ætiology of enlargement of the prostate are so intimately connected that it has seemed best to consider them together, reserving those of clinical pathology and clinical causes for later chapters.

It is a mortifying confession to make, but it is undoubtedly true, that little has been added to our knowledge of the pathology of enlarged prostate within the past fifty years. Those who will read Hodgson's book, for instance, or Sir Henry Thompson's work, and then turn to the most recent expositions of the subject, will find that very few, if any, of the statements made or the theories advanced can be considered in any way an advance from these masterpieces. Yet among all the heterogeneous and at times bewildering arguments promulgated, one fact is prominently seen, that any solution of the difficulty is not to be looked for in repeating and reiterating the old theories proposed on *a priori* grounds: to set the subject of pathology in a state even remotely approaching that of order, we need the detailed study of individual cases; and when we have this, then we may build up our theories *a posteriori*. By this I mean that it is not sufficient to start out with the theory that enlargement of the prostate is merely a local manifestation of general arteriosclerosis, as claimed by Guyon [108] and his school; nor to pronounce all such cases precisely similar to those of fibroid tumors of the uterus, with Velpeau [232], Paget [188], Billroth [23], and their followers; nor, furthermore, to say that the primary change consists in descent of the floor of the bladder, and that the enlargement of the prostate is in the nature of a compensatory hyper-

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trophy, as asserted by Reginald Harrison [116]. It is certain that no one of these theories will suit every case, although I have little doubt that each may express the true causes operative in certain individual patients.

Probably no one observer has seen a sufficient number of cases to enable him to deduct authoritative conclusions; but what is needed is a collective investigation of large groups of cases, which have been reported in such detail, and with such completeness, that a general view may be had of the type of the enlargement; its duration; the clinical history of the case, including previous local diseases, such as gonorrhœa, prostatitis, calculus, etc., and the social habits; as well as a microscopical study of the diseased organ removed either by operation or at autopsy. I am not aware of any such investigations; and as our knowledge is thus unfortunately limited, a satisfactory exposition of the pathology of the prostate gland is a chapter which is still unwritten. The older observers, Home [123], Mercier [159], Desault [66, 67], and others, made quite complete clinical records of their cases; and some very elabourate and painstaking histological studies have been made within recent years, notably by Ciechanowski; but each series is incomplete—the former, because no microscopical studies were possible; the latter, because the clinical histories of the patients are unknown, except in a very few instances. If the patient gives a history of repeated attacks of posterior urethritis and prostatitis, we desire to learn by the microscope whether the changes in the prostate gland present the usual characteristics of "senile enlargement." On the other hand, if we find by the microscope groups of small round cells, catarrhal proliferation, and fibroblasts changing into scar tissue, we desire to know whether the patient in life suffered from prostatitis or posterior urethritis, or whether such changes arose without apparent cause.

It appears in some respects that our ideas in regard to the pathology of this condition have become rather less positive in

PLATE XXIX.

The patient, A. H., aged sixty-three years, was admitted to the German Hospital April 24, 1904. Has always been healthy, and his habits have been good. For over two years he has been passing urine frequently, and during the last six months he has been forced to make water every fifteen or twenty minutes during the day, and has had to get up from six to eight times every night. Although he has occasionally suffered with retention of urine, he has never had a catheter passed, always being able eventually to evacuate his bladder voluntarily. Two weeks ago, however, one of these attacks necessitated catheterization. One week later another attack of retention occurred, whereupon the physician in attendence instituted permanent drainage by an in-lying catheter.

On admission examination showed that the prostate was the size of an orange, hard, and not readily movable.

Suprapubic prostatectomy was done on April 28, 1904. The bleeding was free, but was controlled at the time by irrigation with hot solution. On the following night the hæmorrhage recurred and was twice temporarily controlled by hot douching; the third hæmorrhage was checked by packing the bladder. But the patient did not react from the loss of blood, and died the following day.

The prostate, No. 1866, shown in the accompanying Plates, is a very large one, of the glandular type; its weight was 145 grammes (about 5 ounces).

PLATE XXIX.

VIEW OF THE UNDER SURFACE OF AN ENLARGED PROSTATE (NO. 1866), MEASURING
7 × 6.5 × 6 CM. (2¾ × 2⅝ × 2½ INCHES) AND WEIGHING 145 GRAMMES (ABOUT
5 OUNCES). A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

PLATE XXX.

VIEW OF THE UPPER SURFACE OF AN ENLARGED PROSTATE (No. 1866), MEASURING
$7 \times 6.5 \times 6$ CM. ($2\frac{3}{4} \times 2\frac{5}{8} \times 2\frac{1}{2}$ INCHES) AND WEIGHING 145 GRAMMES (ABOUT
5 OUNCES). THE ENDS OF A CATHETER INTRODUCED THROUGH THE URETHRA
ARE VISIBLE.

proportion to the increase of our knowledge in other respects. The early writers had little doubt that the main cause of prostatic hypertrophy was chronic inflammation, chiefly blenorrhagic in origin; then came the theories already mentioned of general arteriosclerosis, of adenomyomatous changes, and of compensatory hypertrophy. None of these being entirely satisfactory, it was considered that the two main varieties of enlargement—adenomatous and fibrous—were different stages of the same process. But as not even this seemed a sufficient explanation, most recent writers have returned to the original view of an inflammatory cause, and reject altogether the adenomatous theory.

Nevertheless, practically every one is agreed that there do exist two main pathological characters under which enlargement of the prostate gland is seen: one where there is a disproportionate increase in the glandular elements—a pseudo-adenomatous change; and the second where an increase in the stroma of the organ is conspicuous. In either case the increase may be local or general, or both processes may coexist, one exceeding the other in different parts of the same organ.

But while, therefore, these two main classes of pathological change are recognized, some observers have held that they were totally independent; whereas, as already indicated, others have pointed out in the general overgrowth, as a rule almost exclusively fibrous in character, merely an advanced stage of the adenomatous variety. Such was the theory originated by Dodeuil [73], and advocated by Griffiths [104] and by Moullin [176], and that which has been supported more recently by Alexander [5]. But it does not appear to be to me a reasonable theory upon the face of it; nor, so far as I am able to learn, has it ever been satisfactorily demonstrated by tracing an individual prostate through both stages. On the contrary, the patient with the fibrous and hard prostate, of small or moderate size, usually comes to the surgeon with a history of shorter urinary trouble than does he

PLATE XXXI.

The patient, P. J., aged sixty-five years, was admitted to the German Hospital March 5, 1904. For a long time he has had frequent urination, day and night. Four weeks before admission to the hospital acute retention developed; since that time he has had to be catheterized, twice daily at first, lately three times a day.

Examination on admission shows the prostate to be moderately enlarged. The residual urine amounted to 300 cc. (10 ounces).

After a preliminary meatotomy on March 12, the operation of suprapubic prostatectomy was performed March 20, 1904. Recovery was uneventful but rather tedious.

The prostate, No. 1810, shown in the accompanying Plate, was small and fibrous, weighing only 30 grammes (1 ounce).

PLATE XXXI.
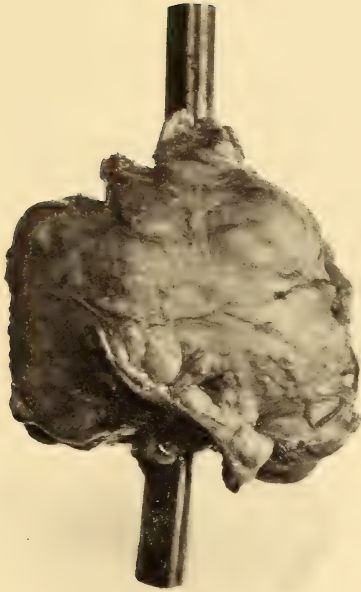
VIEW OF AN ENLARGED PROSTATE (No. 1810), MEASURING 4 × 3 × 3 CM. (1½ × 1⅛ × 1⅛ INCHES) AND WEIGHING 30 GRAMMES (1 OUNCE). A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

whose organ is affected by adenomatous change; and the reverse would be anticipated were the fibrous the terminal stage. It is not unusual for the patient with a large spongy prostate to give a history of urinary difficulty of from ten to fifteen years' duration, or even longer; while one with a fibrous prostate will generally seek relief within a couple of years. And it is incredible that this last mentioned patient should have progressed to the second stage of the disease, as it is called, without having had symptoms during the preceding period when his prostate is presumed to have been soft and adenomatous, and possibly larger. I have examined the records of 50 cases in regard to this point, and find that of 40 belonging to the adenomatous group the average duration of symptoms before operation was over nine years; while in 10 of the fibrous class it was less than five and a half years.

I do not mean to imply that the glandular form succeeds upon the fibrous; for it seems to me that these two varieties are entirely distinct in their evolution, their clinical history, and their treatment.

The case is not altogether the same in the prostate as in the kidney, for example; and yet the sclerosis of interstitial nephritis, where fibrous tissue takes the place of secreting structure, has often been compared to the fibrous changes found in the prostate gland. The question remains unsettled, whether fibrous overgrowth in the kidney is the cause or the result of the atrophy of the renal tubules; but it appears to me by no manner of means reasonable to suppose that an overgrowth in pseudo-adenomatous fashion of secreting structure, which in the prostate is acknowledged to be the first occurrence, should at a later date be caused to atrophy and be replaced by a fibrous growth.

If, then, we look upon these two forms of enlargement as distinct from beginning to end, we are still at a loss for an efficient cause for either. As has already been seen, a number

PLATE XXXII.

The patient, L. F., aged sixty-eight years, was admitted to the German Hospital June 30, 1903. No venereal history was obtained. His bowels were regular; he was a moderate user of tobacco; no alcohol. One week ago he had had an infection of the middle finger of the left hand. For the past two years the patient has had trouble in passing his urine, being often obliged to get up eight or ten times during the night to empty his bladder. He had suffered from some burning upon urination, and had difficulty in starting the stream. Four days before admission he developed acute complete retention, and a catheter was passed only with the greatest difficulty.

On admission 600 cc. (20 ounces) of bloody urine were withdrawn; a false passage was detected in passing the catheter. Rectal examination showed an enlarged prostate quite firm to the touch. The operation of suprapubic prostatectomy was undertaken one week later, July 6, 1903. The wound healed promptly, and the patient was discharged September 11, 1903, entirely relieved of his urinary symptoms.

The prostate, No. 1533, is shown in the accompanying Plate.

PLATE XXXII.

VIEW OF AN ENLARGED PROSTATE (NO. 1533), MEASURING $6 \times 6 \times 4.5$ CM. ($2\frac{3}{8} \times 2\frac{3}{8} \times 1\frac{3}{4}$ INCHES). A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

of pathological processes have been held responsible for the enlargement; and these theories all range themselves under two heads: in one the enlargement is held to be primary—to be itself a cause—to arise *de novo;* and in the other it is considered a secondary change—as the result of some other process —as, perhaps, a misdirected compensatory hypertrophy.

To be strictly sincere, it does not appear to me that it is a matter of very great importance under which of these two theories we enlist our intellect; for it is, after all, a question of purely academic interest, and for practical surgeons will remain such, until some happy discovery shall reveal the true cause of tumor formation in general, or detect why at a certain age the bodily powers begin to fail and the tissues to become sclerotic.

The discussion of the causes has, I think, been much confused by the neglect of writers to keep these two main varieties of enlargement distinct. Guyon's school appears to have confined its observations to the fibrous class, teaching that prostatic enlargement was caused by, or was a part of, the fibrous changes incident to age; while it is evident that Velpeau and his followers fixed their attention exclusively on cases of what I have called the first class, which is, in fact, the larger. Those accepting their views look for an explanation of prostatic overgrowth to the theory of tumor formation in general—tumors having been formerly defined as discontinuous purposeless hypertrophies of no known cause. Were Harrison's theory, which may be classed in the second category, correct, a cure might be hoped for, in cases not too far advanced, from ventrosuspension of the bladder. Such a form of treatment has actually been recommended by Goldman [95], who quotes Perassi and Krynski as favouring it.

Size and Direction of Growth.

Any prostate weighing more than six drachms (twenty-three grammes) may be considered abnormal. From this size they range up to twelve ounces (three hundred and seventy-three

PLATE XXXIII.

The patient, D. D., aged fifty-eight years, was admitted to the German Hospital May 4, 1903. His bowels were regular; he has used alcohol and tobacco moderately. He complains of a burning sensation after urination. About one month before admission he had evidently suffered from an attack of acute cystitis, being compelled to urinate every ten minutes, and passing only 10 to 15 cc. (2 to 3 drachms) at a time. His urine was highly coloured, red, supposed to be bloody. His pain was more marked on moving about. Formerly he was forced to urinate every twenty minutes during the night; of late he has not urinated so often, usually three or four times in a night. The pain starts just above the symphysis pubis and shoots down the penis; there is also a stinging sensation at the end of the penis.

The operation of suprapubic prostatectomy was performed, and a vesical calculus removed at the same time. Recovery was prompt, and the patient was discharged, entirely relieved of his urinary symptoms, June 3, 1903.

The prostate, No. 1469, which is small and fibrous in character, is shown in the accompanying Plate.

PLATE XXXIII.

VIEW OF AN ENLARGED PROSTATE (No. 1469), MEASURING 2 × 1.5 × 1 CM. ($\frac{3}{4}$ × $\frac{5}{8}$ × $\frac{1}{2}$ INCH). A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

·Plate XXXIV.

View of an Enlarged Prostate (No. 1555), Measuring 6 × 4.5 × 3 cm. ($2\frac{3}{8}$ × $1\frac{3}{4}$ × $1\frac{1}{4}$ Inches) and Weighing 52 Grammes ($1\frac{3}{4}$ Ounces). A Catheter has been Introduced through the Urethra.

PLATE XXXIV.

The patient, J. M. C., aged sixty-three years, was admitted to the German Hospital July 18, 1903. He has used alcohol moderately; tobacco to excess. Six months before admission he first noticed difficulty in starting the stream, especially in the morning. As a rule, he was compelled to urinate only once during the night, and during the day he passed urine about four or five times. He stated that the amount passed was scanty, and that he had slight pain on starting the stream. One week before admission he had his first attack of retention, caused by exposure to cold and rain. He was relieved by catheterization, and has had subsequently to be catheterized twice a day.

On admission the amount of residual urine was found to be 60 cc. (2 ounces). Rectal examination revealed a hard mass at the neck of the bladder, about the size of a large hen's egg.

Operation (suprapubic prostatectomy) was undertaken a couple of days later. Recovery was uneventful, and the patient was discharged August 14, 1903, entirely relieved of his urinary symptoms.

The prostate, No. 1555, which is shown in the accompanying Plate, is a good example of the moderately firm fibrous type of enlargement. Its weight was 52 grammes ($1\frac{3}{4}$ ounces).

PLATE XXXV.

The patient, T. C., aged seventy-seven years, was admitted to the German Hospital September 19, 1903. He had been suffering from frequency of urination for years, the calls being more marked at night. Ten days before admission urination became extremely difficult, and three days previously it had become impossible. For two days he had been catheterized by his family physician, but on the third day it became impossible to introduce the catheter.

On admission the bladder was found to be greatly distended, reaching to the umbilicus. A prostatic catheter was passed, several strictures being encountered anteriorly; while in the prostatic urethra there was detected a large false passage, leading to the left. The prostate was greatly hypertrophied, the size of a small orange. The urine obtained by catheterization was very bloody. After treatment by intermittent catheterization for two days, on September 21, 1903, an English catheter was passed, and permanently retained.

Operation (suprapubic prostatectomy) was undertaken September 23, 1903. The patient never rallied, and died from shock and suppression of urine within a few hours.

The prostate, No. 1623, which is shown in the accompanying Plates, weighed 122 grammes (4 ounces), and is a good example of cystic enlargement. See Plate XLVII (facing p. 67).

PLATE XXXV.

VIEW OF AN ENLARGED PROSTATE (NO. 1623), MEASURING 7 × 6.5 × 5 CM. (2¾ × 2⅝ × 2 INCHES) AND WEIGHING 122 GRAMMES (4 OUNCES). A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

PLATE XXXVI.
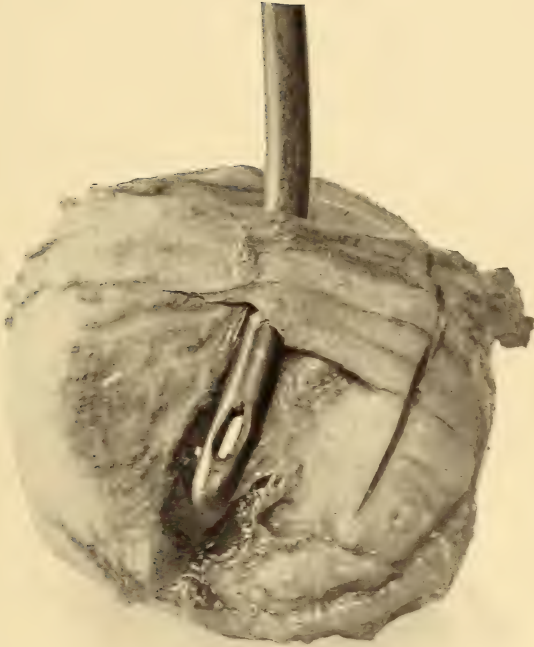
View of the Cut Surface of an Enlarged Prostate (No. 1623), Measuring $7 \times 6.5 \times 5$ cm. ($2\frac{3}{4} \times 2\frac{5}{8} \times 2$ Inches) and Weighing 122 Grammes (4 Ounces).

grammes) or over in weight. Freyer [90] has removed one weighing fourteen and a half ounces. He has also removed prostates weighing ten and a half, and ten and a quarter ounces, respectively, with perfect functional result. The measurements of this last gland were five and a half inches antero-posteriorly, and three and a half inches transversely. The average weight of prostates removed at operation is probably not over three ounces; and the dimensions rarely exceed two inches transversely or three in the antero-posterior diameter. The greater the amount of fibrous tissue present, the less the size of the organ, other things being equal, and the greater the relative weight. The average weight of forty adenomatous prostates I find was $3\frac{3}{4}$ ounces; and of ten fibrous prostates the average weight was 2 ounces.

Hence it is seen that the greatest enlargement takes place, as a rule, in an antero-posterior direction. The lateral lobes are not usually equally enlarged, but neither one is found to be constantly larger than the other. In the majority of instances no marked enlargement of the so-called median lobe exists. That this statement is contradicted by the greater number of museum preparations, is of no weight when we consider the great passion all surgeons may be said to have for preserving curious specimens; thus four or five prostates without a median projection may be discarded for the one possessing such an anomaly, which is preserved. It is very probable, moreover, that the number of patients with median projections who are operated upon is greater than the real ratio of occurrence of such lesion; for where no such obstruction exists, and where residual urine is caused only by transverse obliteration of the urethra, easily overcome by catheterization, the patient is not so liable to be submitted to an operation.

When a median projection into the floor of the bladder just posterior to the urethra does occur, it is probably safe to say that its origin may be traced to one or other of the lateral lobes.

PLATE XXXVII.

The patient, S. L. T., aged seventy-three years, was admitted to the German Hospital July 9, 1903. He states that he has never used alcohol. He had an attack of gonorrhœa when about eighteen years of age. His present illness began two and a half years before admission, with frequency of urination, especially at night; he was obliged to get up every fifteen or twenty minutes to urinate; and often when upon his feet he would pass his urine involuntarily. The flow lacked force, coming in a thin stream. Lately bright blood was present at times. At the beginning of this illness much sediment was passed in the urine.

Examination on admission showed an enlarged prostate, very firm, the size of a lemon.

Suprapubic prostatectomy was performed July 11, 1903. Owing to his advanced age the patient did not react very well, but failed gradually, and died in a uræmic state on July 26, more than two weeks after the operation.

The prostate, No. 1542, which is shown in the accompanying Plates, is an excellent example of the mixed type of enlargement, being partly glandular (Plate XLVIII, facing page 68), and in places extremely fibrous (Plate XLIX, facing page 69).

PLATE XXXVII.

VIEW OF THE UPPER SURFACE OF AN ENLARGED PROSTATE (NO. 1542), MEASURING
$7 \times 6 \times 6$ CM. ($2\frac{3}{4} \times 2\frac{1}{2} \times 2\frac{1}{2}$ INCHES) AND WEIGHING 120 GRAMMES (4 OUNCES).
A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

PLATE XXXVIII.

VIEW OF THE UNDER SURFACE OF AN ENLARGED PROSTATE (NO. 1542), MEASURING
7 × 6 × 6 CM. (2¾ × 2½ × 2½ INCHES) AND WEIGHING 120 GRAMMES (4 OUNCES).
A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

PLATE XXXIX.

VIEW OF THE CUT SURFACE OF AN ENLARGED PROSTATE (No. 1542), MEASURING 7 × 6 × 6 CM. (2¾ × 2½ × 2¼ INCHES) AND WEIGHING 120 GRAMMES (4 OUNCES). A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

PLATE XL.

ENLARGED PROSTATE (No. 1502), MEASURING 6 × 6 × 5 CM. (2⅜ × 2⅜ × 2 INCHES)
AND WEIGHING 100 GRAMMES (3⅓ OUNCES).

PLATE XL.

The patient, H. M. Y., aged sixty-six years, was admitted to the German Hospital June 8, 1903. The patient's father had died of prostatic disease. The patient had always been a moderate user of alcohol. For the past fifteen years he had suffered from frequency of urination, which was most marked at night. Two years before admission he had developed an acute attack of cystitis. In July, 1902, he had been operated upon for vesical calculus, since which time he had had a suprapubic fistula. He has not passed urine through the urethra for six months.

Rectal examination on admission showed a very hard prostate, about the size of a lemon.

Suprapubic prostatectomy was done June 15, 1903; a stone the size of a lima bean was extracted from the bladder, and the prostate removed entire along with the prostatic urethra. Recovery was rather tedious, but the patient was discharged August 1, 1903, in good health, and with no urinary trouble.

The prostate, No. 1502, which is shown in the accompanying Plate, was the seat of considerable catarrhal and interstitial inflammation, as seen by the microscopical section, Plate XLV (facing p. 65). Its weight was 100 grammes ($3\frac{1}{3}$ ounces).

PLATE XLI.

The patient, W. T. D., aged seventy-three years, lawyer by occupation, was admitted to the German Hospital December 3, 1904. He had always used alcohol and tobacco in moderation. He had had the ordinary diseases of childhood, and had had enteric fever twice, in 1862 and 1863. Since that time he has always enjoyed good health.

For a little more than three years he has had slightly more frequent desire to urinate, with occasional imperative urination. Three years ago, after slight alcoholism, there developed acute retention of urine, which was relieved by the catheter. For a week subsequently a catheter had to be passed twice daily, and since this time the patient has had to be catheterized on the average of once in a week or ten days, sometimes only every two weeks; never with any degree of regularity. The chief indication for catheterization was pain; a considerable amount of urine would usually be drawn, and the patient would urinate generally about five times during the night following these catheterizations, though there would be times when he would not get up at all.

On admission there was found to be residual urine amounting to 60 cc. (2 ounces).

Suprapubic prostatectomy was done December 8, 1904. On opening the bladder it was found that the prostate was markedly enlarged, especially upon the right side, which equaled a lemon in size. On attempting to enucleate the whole gland the tip of the much enlarged right lobe broke off from the body of the enlarged organ, and lay free in the bladder. It was removed, and the remaining portions of the prostate were then enucleated in one piece. Uninterrupted recovery followed, and the patient is completely relieved of his urinary symptoms.

The prostate, No. 2138, which is shown in the accompanying Plates, weighed 162 grammes (5⅓ ounces).

PLATE XLI.

VIEW OF AN ENLARGED PROSTATE (No. 2138) WEIGHING 162 GRAMMES (5⅓ OUNCES). VERY MARKED ENLARGEMENT OF THE RIGHT LOBE.

PLATE XLII.

VIEW OF THE SAME PROSTATE (No. 2138) SHOWN IN PLATE XLI.
(a) (b) the right lobe, (b) the intravesical portion.   (c) The left lobe

PLATE XLIII.

VIEW OF THE UPPER SURFACE OF AN ENLARGED PROSTATE (NO. 1826) WEIGHING 56 GRAMMES. A CATHETER HAS BEEN INTRODUCED THROUGH THE URETHRA.

PLATE XLIII.

The patient, A. S., aged sixty-eight years, was admitted to the German Hospital March 25, 1904. He had always enjoyed good health, and had lived a very active life. For fourteen months previous to his admission he had had frequency of urination, and at times had been forced to use a catheter every fifteen minutes. For the last three months he had been confined to bed with a catheter constantly in the bladder. He likewise suffered from diabetes. His general condition, however, improved so much after the institution of continuous drainage, that an operation was deemed justifiable.

Suprapubic prostatectomy was accordingly performed on March 26, 1904. The operation proved to be perfectly successful. Urine was voluntarily passed through the urethra first on April 6, and the patient was soon afterwards discharged with the suprapubic wound firmly healed, and with his urinary functions in normal condition.

The prostate, No. 1826, is shown in the accompanying Plate. It weighed 56 grammes (nearly two ounces), and is a good example of irregular enlargement, the projection of the so-called middle lobe making the under surface of the gland nearly clover-leaf in shape.

In the immense majority of cases carefully examined in recent years, demonstration of such origin has been possible, the pedunculated growth being attached to a lateral lobe much as a subperitoneal fibroid is attached to the uterus. It seems, indeed, not impossible that, in those cases where it has been said that no such attachment existed, the growth had finally torn its pedicle loose, and that it might in time even have migrated, as is not unfrequently the case with the somewhat analogous tumors of the uterus.

There is, however, another condition, well described as the formation of a lip at the vesical orifice of the urethra, which is sometimes mistaken for a median outgrowth. This lip in reality is formed by the enlargement of accessory prostatic glands situated beneath the vesical mucous membrane, and within the limits of the internal sphincter of the bladder. Where an adenomatous mass springing from one lateral lobe projects beneath the mucous membrane in this situation, the internal vesical sphincter is not separated from the bladder by the growth, which merely pushes this sphincter before it. But in the process known as the lip formation, which has been especially studied by Ciechanowski [49], the adenomatous mass is found between the vesical mucous membrane and the sphincter, and may in time, by over-stretching this latter structure, keep the prostatic urethra constantly patulous, and urinary incontinence may even ensue. Such a process as this may exist without any involvement of the prostate gland itself. Residual urine may form in a pouch behind this posterior urethral lip, and indeed all the subjective symptoms of prostatic enlargement may harass the patient. I am persuaded that this is an unusual condition, and it seems to me that some writers make it unduly prominent.

Physical Characters.

When we come to a consideration of the physical characters of the enlarged prostate other than its size and weight, we find

Plate XLIV.

View of the Under Surface of an Enlarged Prostate (No. 1826) Weighing 56 Grammes. A Catheter has been Introduced through the Urethra.

that the most important from a therapeutic point of view is its density. This varies from that of cartilaginous hardness, such that the knife creaks as it cleaves the tissue, to a glandular soft-ness which may perhaps best be compared to a wet sponge of close texture. The former characteristic, hardness, is found exclusively in prostates which contain much fibrous tissue, and which I have placed in the second class; while the softer the organ is found to be, the more surely may it be considered to belong to the adenomatous group of cases. Between these two extremes all grades of density exist; but few indeed are the cases where it is impossible to class the gland readily in one or the other category.

The rate of growth is variable both of the gland as a whole, and of its individual parts. The soft glandular prostates grow with greatest rapidity, and may furnish evidence of increase in size to the palpating finger within a period of a few months. Extremely rapid growth occurs only in neoplasms. The fibrous prostate grows slowly, and, as already remarked, rarely equals the glandular in size. Some authors have even contended for a progressive decrease in size occurring in this form, constituting true prostatic atrophy; but their views have not met with un-reserved acceptance. In the fibrous variety, moreover, it is un-usual to find pedunculated or sessile growths projecting from the surface of the prostate, these so-called prostatic tumors oc-curring almost without exception where the organ has under-gone a glandular overgrowth.

These "prostatic tumors" are quite characteristic. In the prostate have been found at times true tumors, myomata, adeno-mata, and other growths; but what is understood by a prostatic tumor is a localized overgrowth of glandular acini, without in-crease in the number of the corresponding ducts. This acinous overgrowth compresses the surrounding stroma into a capsular envelope, which it has been customary to regard as a myomatous growth, the prostatic tumors being denominated adenomyomata.

Later investigations, however, have shown that this capsule is in reality composed of new connective-tissue elements, or fibroblasts, while the muscle tissue probably does not increase in quantity. In time the stroma surrounding these localized glandular outgrowths itself begins to grow, and may eventually, according to Moullin [176], compress the pre-existent acini, so that the prostatic tumor formerly almost wholly glandular in character becomes eventually fibrous and solid. Moullin claims that increase in size, though less rapid, still continues during this which he calls the second stage of the pathological process. Whether or not we accept this view, that the fibrous is a subsequent stage of the glandular change, it is certain that the prostatic tumors, no matter what their state, are under considerable pressure from the surrounding stroma, and that they tend to grow in the direction of least resistance. This latter fact frequently causes them to project beneath the mucous membrane of the bladder, posterior to the urethral orifice. When seated within the substance of the gland, they are prone to start out of it on section, and may readily be enucleated with the finger, the few ducts from which the numerous new acini spring, unless they are included in the section, serving as their pedicle of attachment to the rest of the organ.

In some cases no such prostatic tumors are found, the gland presenting a nearly uniform, general enlargement, either glandular or fibrous in character; or a general glandular enlargement may exist in some areas, and a general fibrous enlargement in others. When this is the case, no nodulation of the surface occurs, and there can be, of course, no "median lobe" present.

When a large part of the prostate becomes intravesical, it is usual to observe a constriction between this and the extravesical portion. This constriction is produced by the edges of the prostatic sheath, which as Mr. Freyer [90] says, has been shouldered aside by the prostate in its efforts to expand beneath the mucous membrane of the bladder.

PLATE XLV.

A Section from Prostate No. 1502 (See Plate XL) showing Considerable Hyperplasia and Some Dilatation of the Glandular Structures.

For the most part the lining epithelial cells are disposed in a single layer, but here and there there are two or more layers, which, together with the mucoid infiltration of the cells and the periacinar round-cell infiltration, indicate catarrhal and other inflammatory alterations. ($\times$ 250.)

Pathological Histology.

Our knowledge of the pathological histology of the enlarged prostate is due almost entirely to the monumental and exhaustive work of Ciechanowski [49,50], supplemented by the researches of Albarran and Hallé [3], of Motz [172a], of Greene and Brooks [102], of Crandon [54], of Daniel [56a], and of Herring [120a]. Ciechanowski's original article was published in 1896 in Polish, and hence did not find a very large circle of readers. It was re-published in German in 1900, after being in the editor's hands for nearly two years; but it was only on the appearance of an article from his pen in French in 1901, that his views became widely known and thoroughly appreciated.

His studies fall into two groups, in the first of which he discusses the changes occurring in the bladder as the result of old age, of prostatic obstruction, and of chronic cystitis; the second division being devoted to a consideration of the prostate itself.

By careful and repeated microscopical measurements he showed that vesical insufficiency occurred from a diminution in the amount of muscular tissue in the bladder walls. He detected no increase in the connective tissue except where chronic cystitis was present. This is in accord with the clinical observation of Guyon [108], who noted that if no cystitis was present the residual urine gradually accumulated without producing many symptoms, until the bladder might be distended to above the umbilicus, before overflow from retention occurred; whereas if infection was present frequent urination arose early in the case, and the bladder did not dilate, but became thickened and contracted.

Ciechanowski held, and Greene and Brooks as well as Crandon, who each undertook a separate examination of his conclusions, agree with him, that both the glandular and the fibrous overgrowths of the prostate are the long-delayed result of a chronic inflammation, insidious in onset, slow in course, and for many years perhaps entirely latent. The process of overgrowth Cie-

6 P

chanowski thinks may be observed to occur simultaneously in both the glandular and the stromal portions of the prostate.

The description given in the following pages is freely borrowed from the authors above mentioned, and to their works I here desire to express my indebtedness.

Examination of a microscopical field from an enlarged prostate shows most noticeably, as a rule, increase in glandular structure. Some have thought that new acini were formed, as in the case of the true adenomata observed in the mammary gland, where the chief pathological change evident is the preponderance of glandular tissue over the normally present fibrous reticulum; but in the prostate the process does not appear to be one of true tumor formation, since it seems certain that these extra gland acini are merely dilated gland tubules which, though previously present, were then insignificant in size. Study of the mucous membrane lining these gland spaces shows a variety of changes present. The cells may exist in only the usual single layer, or they may be heaped up into several layers, showing a catarrhal inflammation in which new cell formation has taken the place of secretion. In this way the acini may become closely packed with epithelial cells, simulating on hasty examination cancer nests. Albarran and Hallé [3] observed epithelial proliferation such as this in fourteen out of one hundred cases examined, and classed them all as commencing carcinomatous degeneration. But as pointed out by Greene and Brooks [102], such a large percentage would be unheard of, and contrary to all clinical evidence. Moreover, these authors found such acini in many of their own cases which were undoubtedly not cancerous; so it seems safe to conclude that a carcinomatous change cannot be diagnosticated unless epithelial cells can be found displaced from the alveoli and proliferating in the stroma. This condition was also observed by Albarran and Hallé [3], some of whose cases were undoubtedly instances of carcinoma; and while we must reject their former conclusions as erroneous, we must yet
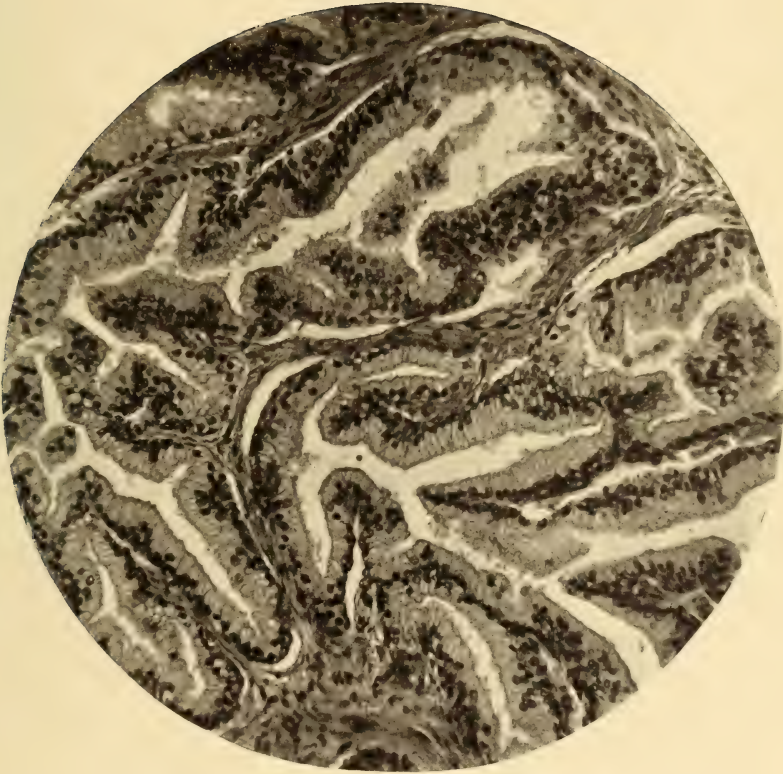
PLATE XLVI.

A Section from Prostate No. 1258 showing Marked Glandular Hyperplasia.
(Photomicrograph, × 280.)

PLATE XLVII.

A Section from Prostate No. 1623 (See Plates XXXV, XXXVI) showing Cystic Dilatation of the Acini with Consequent Flattening and Atrophy of the Lining Epithelium. ($\times$ 180.)

be grateful to them for calling our attention to the not very remote possibility of malignant change.

In some cases the acini will not be completely filled with epithelial cells, but there will be such an admixture of lymphocytes, and even of polymorphonuclear leukocytes, as to constitute true suppuration; the prostate in these cases being riddled with minute abscesses, although outwardly presenting only the usual evidences of senile enlargement.

If secretion takes the place of cell proliferation, the single layer of columnar cells will still surround the acinus, but this will be dilated by a variable amount of mucoid material, very probably containing one or more concretions. In some instances extreme dilatation of a few of the acini is present, and the well-known though rather rare cystic prostate is produced. In some of these cases the epithelial lining is squeezed out of existence entirely, and the cyst is surrounded only by stroma. The cells may at times be seen lying in rows detached from the acinous wall, free in its cavity. Sometimes two neighbouring acini are seen with only a thin partition between them; and it is easy to conceive how the coalescence of two or more such acini might occur.

Turning our attention now to the ducts, we find that these are, as a rule, compressed in direct proportion to the dilatation of the acini. In some places a duct will be seen with its opposed mucous linings flattened by pressure; and other ducts may be found which have become converted into fibrous bands, with no trace of epithelial structure remaining. It is to be noted that the prostatic concretions have never been observed to plug the ducts; these seem to be always compressed by an outside influence. Yet Daniel [56a] was "struck by the frequency with which the ducts are obstructed by lecithin or amyloid bodies, desquamated epithelium, or pus cells."

This process of proliferation in the acini, and compression of the ducts, leads in many instances to the formation of the "prostatic tumors," or pseudo-adenomata, previously discussed. But

for an explanation of this process we must advance our observations from the glandular structure and consider the changes found in the stroma.

One of the first things to meet the eye as it studies the stroma is the collection here and there of groups of small round cells— true round-celled infiltrations, according to Ciechanowski [49] and others. These aggregations of cells are not regarded by Crandon [54] as at all the same as the lymph nodes described by Walker [235] as occurring in the normal prostate. They are most frequent beneath the mucous membrane of the urethra, then in patches along the excretory ducts; but are also sometimes observed surrounding the terminal alveoli. These round-celled infiltrations are here, as elsewhere, significant of inflammation, and indicate a rather acute process in their immediate locality. But in the enlarged prostate they are seldom observed in large areas, or very uniformly distributed. They seem rather to be aggregated in a few spots for some recent local inflammation.

The stroma surrounding the ducts, and that immediately about the acini, shows the presence of true fibroblasts, the same that are seen in areas formerly inflamed, but becoming cicatricial. And in other spots of the stroma may be seen fully formed fibrous tissue—true cicatrices—where the contracting fibroblasts have perhaps compressed and even obliterated one of the excretory ducts or an acinus. Evidence of this last event is found in the occasional existence of a prostatic concretion in the midst of scar tissue, this concretion having naturally resisted the obliteration which its containing acinus suffered. The muscle cells are not found to be hypertrophied. What were formerly considered muscle cells are now recognized as the fibroblasts. But it is not impossible, when an acinus first begins to dilate, that for a short time its immediately surrounding muscle cells may hypertrophy, and endeavour to evacuate the contents of the retention cyst forming within their embrace. But any such hypertrophy, if it ever exists, is very soon overcome by the fibrous growth.

PLATE XLVIII.

A Section, from Prostate No. 1542 (See Plates XXXVII, XXXVIII and XXXIX), showing Considerable Glandular Hyperplasia Adjacent to Much Connective Tissue Overgrowth, and Two Corpora Amylacea.

The connective tissue hyperplasia was more marked in other portions of the specimen (Plate XLIX), and throughout the specimen there was a moderate amount of round-cell infiltration, especially about the blood-vessels. (× 180.)

PLATE XLIX.

A Section from Prostate No. 1542 (See Plates XXXVII, XXXVIII, and XXXIX), showing Marked Connective Tissue Hyperplasia with Considerable Atrophy and More or Less Complete Obliteration of the Acini.

In another portion (Plate XLVIII) there was considerable glandular hyperplasia, and throughout the specimen there was a moderate amount of round-cell infiltration, especially about the blood-vessels. ($\times$ 100.)

The particular form of the enlargement found depends entirely for its glandular or fibrous character on the situation of the intraglandular and interglandular changes, and on their relation to each other.

If the intraglandular changes occur most markedly in the periphery of the gland, that is to say, away from the ducts, while the interglandular or stromal changes arise chiefly in the interior of the gland, around the prostatic ducts and about the urethra, then the character of the enlargement is adenomatous, since the ducts are obstructed, and the acini undergo cell-proliferation or cyst formation.

But if the periglandular changes are most marked in the periphery, then the acini are compressed, perhaps obliterated, by the surrounding growth, and the ducts are all that remain of the glandular structure of the prostate, which may then be a mere mass of scar tissue. If the scar tissue continues of the embryonic type, consisting largely of fibroblasts, the prostate will enlarge, though very slowly; but if true fibrous tissue forms, it is probable that a decrease in size will occur.

As remarked before, it does not seem to me at all likely that one of these processes succeeds upon the other. It appears to me far more rational to suppose that an enlargement which has commenced by constriction of ducts and dilatation of acini, will continue as such for all time, or until a prostate the size of a cocoanut has been produced; and that a process in which the gland acini are compressed and obliterated by fibrous tissue which is more marked in the periphery than in the centre of the prostate, has been such from the beginning; not that the large adenomatous structure subsequently became fibrous.

The fibrous form is generally admitted to be distinctly rarer than the adenomatous, but Greene and Brooks [102] found it to preponderate in the specimens, fifty-eight in number, examined by them.

These authors describe the clinical course of the disease in the following terms:

Suppose, for instance, that acute inflammation of the prostate arises. "With a cessation of acute inflammation following a removal of its cause and normal reaction on the part of the tissues of the organism, interstitial hyperplasia should cease, and retraction and atrophy follow from sclerosis of the fibers, as the embryonic tissue takes on adult form. Such a result does follow in favorable cases of prostatitis in the young and healthy, and, as the sclerosis of the newly formed tissue continues, the atrophic or small hard prostate follows to a greater or less extent, always provided, however, that this same fibrous sclerosis does not excite secondary changes in the glandular epithelium. But in the middle-aged or old man, particularly where more or less general or arterial disease exists, resolution and healing do not so readily follow, and instead of cessation of connective-tissue hyperplasia the condition becomes chronic. With the increased fibrosis, consequent thickening of the walls of the veins and lymphatics follows, and chronic congestion is added to the factors tending to prolong and increase interstitial hyperplasia, edema and inflammatory exudation. So it happens that in the enlarged prostate of the aged, acute and subacute proliferations are found mingled with the thickened masses of adult sclerosed connective tissue. As an inevitable result of this overgrowth of stroma, atrophy of the smooth muscle cells follows. This may be of greater or less degree, greater if the inflammation partakes more of the acute type where parenchymatous degenerations are most rapid, less if the process be more chronic."

Thus by a fibrous overgrowth alone, continuing for months or years, the prostate may be considerably increased in size; but when the glandular changes are concerned as well, quite rapid enlargement may occur. Greene and Brooks [102], who, it will be remembered, found the fibrous type of enlargement more frequent in their specimens, seem to incline to the opinion that

it is the primary change, and that epithelial or glandular pro-
liferation is produced by it. Their views, however, are not very
clearly expressed.

Whether these recent views as to the invariably inflammatory
origin of prostatic enlargement will be hereafter disproved, re-
mains to be seen. It is at present the easiest solution of a vexed
question; but I am not sanguine as to its being final.

Two things seem to me to need emphasis: the first, that the
truly adenomatous origin of the glandular form does not appear
to have been disproved; and, secondly, the very great importance
of chronic passive congestion, or call it chronic inflammation if
you will, in the production of the fibrous form of prostatic
enlargement.

CLINICAL PATHOLOGY: EFFECTS ON URETHRA, BLADDER,
KIDNEYS, URINE, AND RECTUM.

As the prostate gland enlarges, whether from tumor formation
or as the result of a general hyperplastic process, various changes
are produced in the urethra, the bladder, and the rectum; and
less directly on the urine, the kidneys, and the general health.

Effects on Urethra.

The length of the urethra is probably always increased. Its
normal length averages eight inches (20 centimetres), according
to the extensive statistics compiled in 1898 by Keyes [132]; but
it varies from six to ten inches in health, and thus a length of over
eight inches may be no longer than normal for any individual
patient; while, on the other hand, the urethra may be abnormally
long by two inches when its length merely reaches the average.
In drawing conclusions from such measurements the patient's
height, his age, and the length of his penis, should all be borne
in mind. The urethra is generally considered to increase slightly
in length with advancing years, apart from any pathological
change; and, other things being equal, the taller the patient,
and the longer his penis, the greater may be expected to be the
length of his urethra. The length of the penis, however, and
consequently that of the urethra, varies so much in the same
individual, according to the local temperature and nervous emo-
tions on being examined, that this increase, unless marked, and
accompanied by other symptoms, cannot be regarded as of very
great importance. One more point in this connection should be
borne in mind; that is, that when the bladder is full, and the
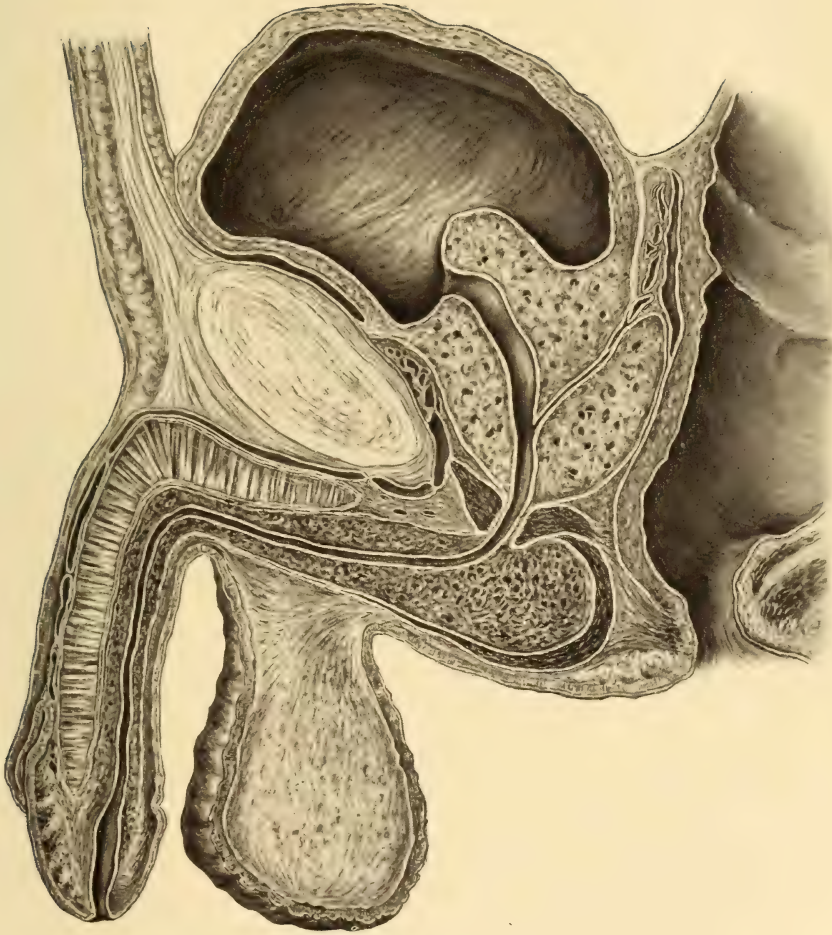
PLATE L.

ELEVATION OF VESICAL ORIFICE OF THE URETHRA AND FORMATION OF A RETRO-
PROSTATIC POUCH.
Note the increased curve and length of the subpubic urethra.   Compare with Plate XII.

PLATE LI.

LATERAL DEVIATION OF THE URETHRA TOWARDS THE PATIENT'S RIGHT, DUE TO OVERGROWTH OF THE LEFT LOBE OF THE PROSTATE.—(*After Anger.*)

desire to urinate is present, the prostatic urethra, unless retention occurs, becomes physiologically part of the bladder; and the urine is withheld from the bulbous urethra only by the voluntary muscles surrounding the membranous portion of this canal. Hence it will be found that if a catheter is passed into the bladder to draw off residual urine, or urine which there is no desire to evacuate, the whole length of the urethra, including the prostatic portion, will be traversed before any urine flows; whereas if desire is present, and the prostatic urethra is in physiological continuity with the bladder, a corresponding length of catheter will be subtracted from the total length formerly required.

The length as measured will also be greater in a curved than in a straight instrument.

In some of these cases the length of the urethra may be increased up to fourteen or sixteen inches; so that where urinary retention is evident the surgeon must not be discouraged on failing to reach the bladder with the ordinary length of catheter.

This increase of length occurs chiefly in the prostatic portion, which may measure as much as four inches. The bulbous urethra is also lengthened.

The means by which this increase in length is brought to pass may be explained by the fixation of the prostate gland at its apex, and the necessity which therefore exists for any enlargement to take place in a posterior direction. As will be remembered, in speaking of the relational anatomy of the prostate, attention was called to the greater firmness of its attachment to the rectum, as compared with its superior relations; hence its greater enlargement is usually found extending into the floor of the bladder, this being a more compressible viscus than the rectum, which is so often filled with solid fæcal matter, while the fluid contents of the bladder offer little resistance to prostatic encroachment. The enlargement upward of the prostate explains how in the enlarged organ the prostatic utricle comes to occupy the lower part of the prostatic urethra instead of its centre.

The fact that the neck of the bladder is thus encroached upon brings about a second change in the urethra, and this is in its direction. The vesical orifice of the urethra is thus raised from its normal situation, even where no isolated median enlargement exists; and the vesical half of the prostatic urethra may in extreme cases assume a right angle with its outer portion, so that the curve of the ordinary metal or English catheter will not fit the prostatic urethra, its point impinging upon the posterior wall. Besides a change in direction in the sagittal plane thus produced, there may be a lateral deviation of the urethra, due to unequal enlargement of the two lateral lobes, the channel being deflected towards the less enlarged lobe. Hence in passing a metal catheter in cases of obstruction from enlarged prostate, if the beak of the instrument cannot be made to ride over the obstruction by depressing its handle, the surgeon should turn it first to one and then to the other side. If a pedunculated enlargement exists just back of the vesical orifice, a Y-shaped channel may be present, and the catheter will pass to either side of the median line.

By the same process by which the vesical orifice of the urethra is raised, the posterior or inferior wall of the prostatic urethra is much lengthened; and if no corresponding growth occurs in that portion of the prostate anterior to the urethra, and the anterior wall of the prostatic urethra remains unchanged, the diameter and consequently the capacity of the prostatic urethra may be much increased, so that it may hold an ounce or two of urine. Such extreme enlargement is, of course, rare; indeed, it more often happens that this portion of the canal is more or less compressed by the centripetal enlargement of the lateral lobes, so that on transverse section it appears as a vertical chink, instead of the normal crescentic outline. If this lateral compression be marked, and it is more apt to be so in cases of fibrous overgrowth than in adenomatous enlargement, total retention of urine may ensue, even though the vesical orifice of the urethra be not dis-

PLATE LII.
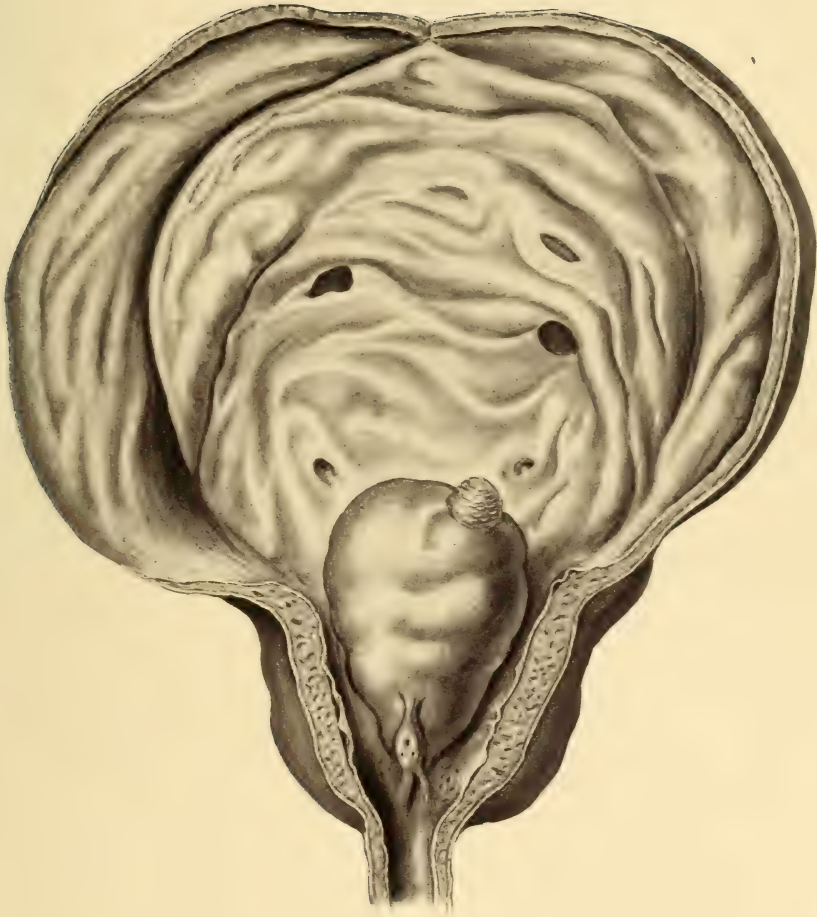
FORMATION OF A Y-SHAPED CHANNEL DUE TO PRESENCE OF A PEDUNCULATED
"MEDIAN LOBE."

Several orifices of vesical pouches are also seen. A small concretion is attached to the
"middle lobe."—(*After Cruveilhier.*)

PLATE LIII.
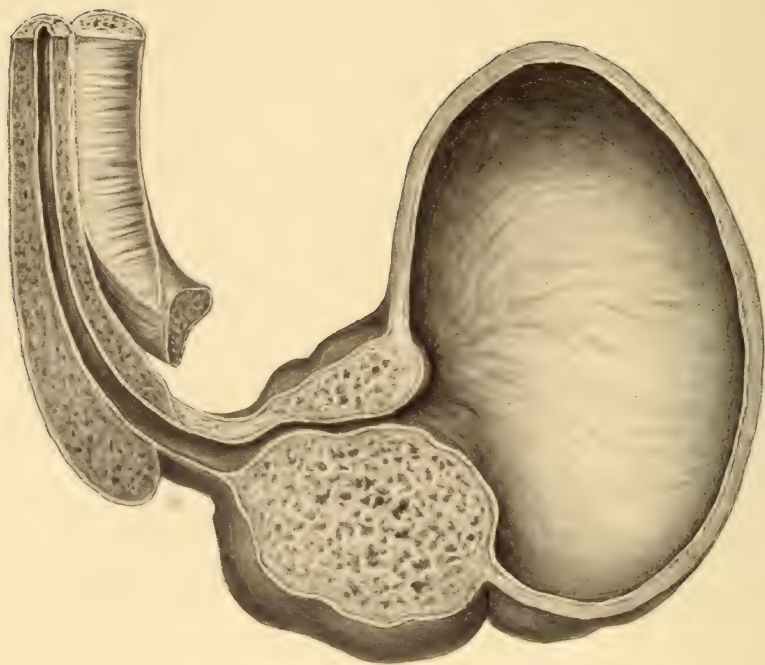
OVERGROWTH OF SUBURETHRAL PORTION OF PROSTATE, CHANGING SUBPUBIC CURVE OF URETHRA.—(*After Anger.*)

placed, and the catheter enter with its usual facility; for while a catheter may easily overcome very considerable lateral compression, the bladder will be unable to effect a like dilatation of the canal by hydrostatic pressure applied only to its vesical orifice. Instead of retention of urine being produced by the deformities of the urethra caused by enlargement of the prostate, true incontinence of urine—not merely retention with overflow—has occasionally been noted where the eccentric growth of the prostate keeps the urethral orifice constantly patulous.

If the parts below the urethra enlarge with greater rapidity towards its floor than towards the vesical trigone, the normal curve of the subpubic urethra may be obliterated, the canal here becoming straight; or its convexity may even be directed forwards, towards the pubic symphysis. In such cases the catheter must be reversed before it will enter the bladder. (Plate LIII.)

Vignard [234] has shown that among twenty-eight specimens which he examined, in sixteen obstruction to urine existed throughout the whole prostatic urethra; in nine cases the obstruction was chiefly at the vesical orifice, but also to some extent in the urethra; while in only three out of the whole twenty-eight cases did it exist at the vesical orifice alone.

Besides the changes in length, direction, and size, to which the prostatic urethra is thus subject, it may be curiously distorted by submucous adenomata springing into its canal from any direction, most frequently from beneath its floor. Failure to remove such masses, palpable neither from within the bladder nor from the perineum, is the probable explanation of persistence of symptoms after many a prostatectomy.

The large submucous veins of the prostatic urethra become much engorged along with all other neighbouring veins, and by a sudden access of congestion are the chief cause of attacks of acute retention of urine. They may bleed spontaneously at times, and even the most gentle catheterization may provoke considerable hæmorrhage.

Effects on the Bladder.

Of all the changes produced in the bladder by enlargement of the prostate gland, none is of greater importance than the formation of a post-prostatic pouch, by the combined elevation of the urethral orifice and descent of the vesical floor. This is probably a much more frequent cause of residual urine than is the ball-valve action of a pedunculated submucous adenoma blocking the urethra.

The descent of the vesical floor is the result, not the cause, as Mr. Harrison [116] maintained, of the enlarged prostate. Where obstruction exists to the evacuation of a hollow viscus, it is surely always the preceding change, and the dilatation which is found arises from vain efforts to expel the contents. A familiar example of this is seen in pyloric stenosis. If this obstruction be overcome, by gastroenterostomy or otherwise, the atonic stomach recovers its normal physiological action in the vast majority of instances. Similarly, if the urinary obstruction be removed, by excision or even by suprapubic drainage, the dilated and feeble bladder will recover, if the condition has been relieved in time.

The prostatic obstruction throws increased work on the bladder, as Mansell Moullin [176] has well said, and when it is no longer able to empty itself, the floor, which is the part last to be emptied as well as the weakest, is the first to dilate. When this stage has been reached, every effort of the bladder for evacuation only serves to press the urine against its floor and to increase the capacity of the post-prostatic pouch.

The shape of the urethral outlet of the bladder may be variously altered according to the part of the prostate most overgrown. It is usually crescentic in outline, the concavity of the crescent being directed towards the most enlarged part. But if the prostate enlarges nearly equally in both its supra-urethral and infra-urethral portions, a collar-like projection will occur into the bladder all around the urethral orifice. This form of enlargement

PLATE LIV.
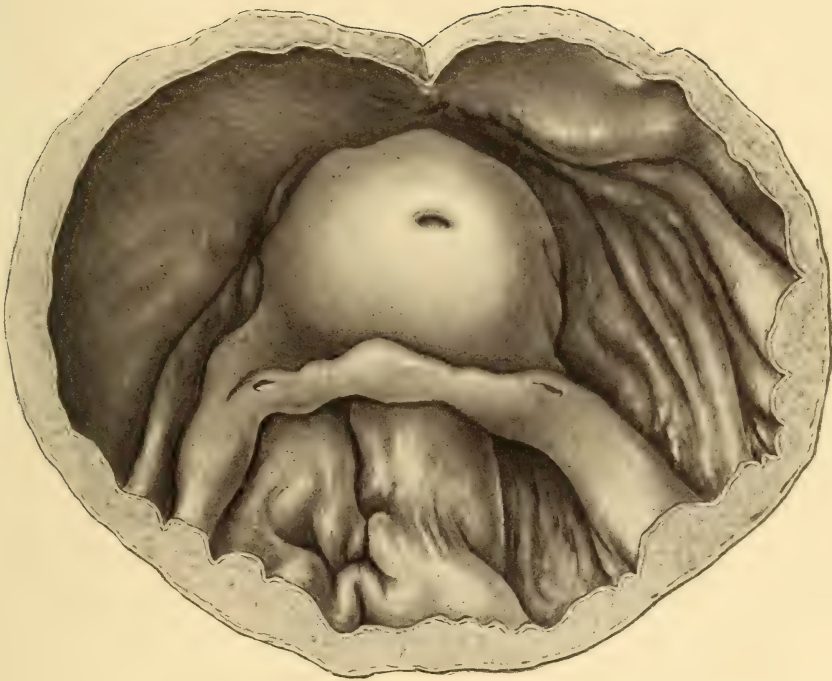
COLLAR-LIKE OR "CERVIX UTERI" ENLARGEMENT OF PROSTATE, SEEN FROM WITHIN THE BLADDER.—(*After Socin and Burckhardt.*)

PLATE LV.

ENLARGEMENT OF THE LATERAL LOBES OF THE PROSTATE FORMING BETWEEN THEM
A BAR AT THE NECK OF THE BLADDER.—(*Watson.*)

has been graphically compared, both in appearance and in feel, to the cervix of the uterus, the urethra being placed in the midst of a hillock, like the cervical canal between its lips. (Plates LIV and LVI.)

If the lateral lobes enlarge uniformly and tend to spread away from the middle line, they are apt to raise a fold of tissue taut across the vesical orifice of the urethra. This fold may be composed of mucous membrane alone, or may have a varying amount of submucous tissue in it as well. It is the most usual form of "bar at the neck of the bladder," and in many instances is a serious obstacle to catheterization. (Plate LV.)

As has been already remarked, an isolated adenomatous mass, springing from the prostate beneath the neck of the bladder just posterior to the urethral orifice, may cause the inner part of the urethra to become Y-shaped. (Plate LII.)

Very great impairment of the urinary function may result when there is no apparent mechanical obstruction. In such cases the cause of the trouble is the existence of a hard œdema, or of an arteriosclerosis or fibrosis in the neck of the bladder and the prostate. Such processes, the result of long preceding congestions or chronic inflammations, render the normally soft and pliable vesical outlet firm and rigid, so that the prostatic urethra can no longer open up into practical continuity with the bladder during urination; and as a consequence, obstruction arises from the immobility of the parts. In such cases the prostate may be little or not at all enlarged, but extremely hard; thus furnishing a marked example of the fibrous class.

While the most prominent changes in the bladder are thus seen to occur in the neighbourhood of its neck and the trigone, certain alterations throughout its walls occur in many cases, and these are of nearly equal importance. They are partly the result of the efforts to overcome the obstruction, and partly the result of the chronic cystitis which almost invariably accompanies prostatic enlargement.

The increased work thrown on the bladder causes first an hypertrophy of its muscular walls. If the obstruction is not relieved in time, atony ensues, with dilatation of the bladder, or fibrous degeneration takes the place of the hypertrophy, and the bladder contracts. In cases where the obstruction is unrelieved, chronic retention occurs, and the amount of residual urine gradually increases. The walls of the bladder may then become much distended and extremely thin; and its fundus may reach to the umbilicus or above, before partial relief occurs from overflow. Atony of the bladder from actual disappearance of its muscular fibres through fatty degeneration may thus arise; and although atony so extreme as to be irremediable is no longer thought to be very frequent, yet the surgeon should bear this danger in mind, and see that his patients are relieved of their retention before matters have gone too far.

But the bladder may not dilate; its walls may become much thickened, corrugated and pouched; its cavity may even contract, and contain only a few drachms of urine, necessitating its evacuation every ten or fifteen minutes. As the muscular walls become fibrous they contract on the contained mucous coat, and this may be seen bulging out in pouches in the interstices between the thickened fibrous bands, as efforts to expel the urine are made. These herniated pouches may in time remain permanently, not disappearing even when the bladder is relaxed. In such cases not only may residual urine collect in these pouches, but calculi may form in them, and thus much increase the pain and discomfort of the patient.

The changes in the bladder walls the result of cystitis differ in no respect from those due to cystitis from other causes. Vesical catarrh is a prominent symptom, and the viscid ropy mucus adds to the urinary obstruction. The mucous membrane is highly congested; it may be ulcerated in places; and calcareous deposits are frequently found on its surface. So turgid are the veins that it is the rule for some degree of hæmaturia to be developed as soon as the bladder is relieved of the urinary pressure.

PLATE LVI.

ATONIC, DILATED BLADDER, FROM ENLARGEMENT OF THE PROSTATE WITHOUT MARKED CYSTITIS.

(From a specimen in the Mütter Museum of the College of Physicians of Philadelphia.)

Where infection is present, it is probable that chronic urinary retention so extreme as to produce overflow never occurs; but that the acute pain and frequency of urination claim the surgeon's services at an earlier stage of the case. It is therefore in the infected cases that the small rugous and thickened bladders above referred to are oftenest encountered; and it may be considered a question whether the infection causes the contraction primarily, or whether this occurs only because the high grade of cystitis present makes relief to obstruction imperative before dilatation of the bladder has taken place.

Effects on the Kidneys and Ureters.

From the presence of residual urine in any amount, changes may further be observed in the orifices of the ureters. Normally these tubes enter the bladder wall obliquely, passing through the vesical coats for one-quarter or one-third of an inch; and they discharge their contents into the bladder in driblets or in spurts at intervals of some seconds. But as the bladder becomes distended the ureteral openings are compressed, and the discharge of their contained urine becomes more difficult. When the bladder is excessively distended, and its wall is overstretched in all its parts, the ureteral orifices may become constantly patulous, by the approximation of their course through the bladder walls to a straight line. Dilatation of the ureters may result. (Plate LVIII.)

As soon as the pressure in the ureters becomes increased, a damming up of urine occurs into the pelvis and calices of the kidneys; and this change in pressure, apart from any infection, is soon manifested in the behaviour of the kidneys themselves. Circulatory disturbances are produced in the kidneys, the immediate effects of which are not accurately known; but from the observations of Cabot [41] it is evident that in their early stages they are not beyond the hope of cure. Generally speaking, it is pretty sure that this increased pressure alone, even without

any infection, will cause the production of fibrous overgrowth in the kidneys, as well as an increase in the quantity and a decrease in the specific gravity of the urine excreted. That the primary change in the kidneys is probably atrophy of secreting structure, while fibrous hyperplasia is a subsequent occurrence, has long been an accepted theory; but as I have already remarked, I do not think this same sequence of events has been proved to occur in the diseased prostate, although here also it is a plausible and a most convenient theory.

Where infection exists as well, and especially where the vesical orifices of the ureters are more or less patent, pyelitis and surgical kidneys soon develope.

Effects on the Urine.

The residual urine almost invariably becomes alkaline, and is a prolific cause of cystitis. Being alkaline, phosphatic or mulberry (oxalate of lime) calculi are prone to form. It has been estimated that nearly one-quarter of all patients with enlarged prostate have calculi as well. The calculus, however, being usually fixed rather firmly in the post-prostatic pouch, frequently gives no characteristic symptoms, and is difficult of detection with a sound. Especially is this the case where a calculus forms in or becomes subsequently lodged in one of the pouches already alluded to; or when its surface becomes covered with mucus, or it is surrounded by prostatic overgrowths. As already mentioned, the urine may be deposited in calcareous crusts over the entire vesical walls.

When chronic cystitis develops the urine presents the well-known characteristics of this disease. Shreds of mucus, pus, clots of blood, and various crystals may be found. Ammoniacal decomposition is frequent. The colon bacillus, imparting to the urine its characteristic odour, may be the infecting medium; it is not impossible for this germ to gain entrance to the bladder directly from the intestinal tract, though of course its more usual

PLATE LVII.

CONTRACTED, INFECTED BLADDER, WITH THICKENED WALLS AND THE FORMATION OF
VESICAL SACCULI, FROM ENLARGEMENT OF THE PROSTATE ACCOMPANIED BY MARKED
CYSTITIS.

(From a specimen in the Mütter Museum of the College of Physicians of Philadelphia.)

avenue of approach is through the urethra. Streptococci, staphylococci, and other micro-organisms are also found.

The pus, the mucus, but especially the blood clots, are frequent causes of stammering in micturition; and as they are sucked into the eye of the catheter impart to the hand a readily recognized sensation. The blood may come from spontaneous rupture of engorged veins, or from trauma by a calculus or a catheter. At times the clots are found nearly filling the cavity of the bladder.

When the kidneys become affected the urine becomes correspondingly altered, as seen in the early stages of interstitial nephritis from other causes. The quantity passed in twenty-four hours may reach ninety or a hundred ounces, or even more; the specific gravity will show a proportionate decrease; and albumen and tube casts may be detected. It should not be overlooked, however, that renal disease may have long antedated the prostatic trouble.

Effects on Urination.

Such widespread and serious changes throughout the urinary apparatus cannot fail to produce marked changes in the manner and the power of micturition. These will be more fully discussed under the heading of symptomatology, but it is well to recall briefly in this place the *modus operandi:* residual urine causes cystitis; cystitis causes frequent desire for urination; frequent urination increases the existing congestion; this in turn may bring on retention of urine; catheterization is resorted to, once or oftener; infection is very liable to occur in a bladder already so inflamed; the retention and the infection of the urine produce circulatory disturbances in the kidney; the quantity of the urine is increased, and a vicious circle is established, which, unless the primordial cause, urinary obstruction, be removed, will quickly affect the patient's general health.

The dilatation of the bladder, and consequent weakness of

7 P

its walls, causes two well-known symptoms—feeble power of expulsion, and slowness in completing the urinary act; while finally the inability of the vesical neck to act properly, and the interference with the muscles around the membranous urethra, cause the last portions of urine to be voided in dribbles, no power remaining of evacuating it in spurts.

Effects on the Rectum.

Enlargement of the prostate, as is well known, is very apt to be accompanied by hæmorrhoids and prolapsus ani. These affections may be produced by the prostatic hypertrophy, or they may be due to an independent though concurrent cause.

Venous engorgement of the prostate and the vesical neck is one of the main causes of sudden urinary retention, as mentioned above; and such venous engorgement, when prolonged or when recurring frequently, leads soon to a varicose condition of the prostatic plexus. Under these conditions incompetency of the valves in this plexus developes, and the blood regurgitates through communicating branches, and becomes dammed up in the internal pudic and the middle and inferior hæmorrhoidal veins. Since these all, as well as the prostatic plexus itself, empty into the internal iliac vein, no real relief to the venous obstruction ensues; but hæmorrhoids develope, and by their pain add to the misery of the patient. Some slight relief might occur from vascular overflow into the superior hæmorrhoidal veins; but as these are radicles of the portal system, which has no valves, and which is very apt to be already congested or obstructed in persons who have reached the prostatic age, the superior hæmorrhoidal veins are only too often varicose even before the middle and inferior become so. Phleboliths are common in the prostatic plexus.

Not only does prostatic enlargement affect the rectum in this manner by producing hæmorrhoids, but it may seriously obstruct the rectal canal when the gland is much enlarged in this direction. The act of defæcation is rendered difficult and painful by this

PLATE LVIII.
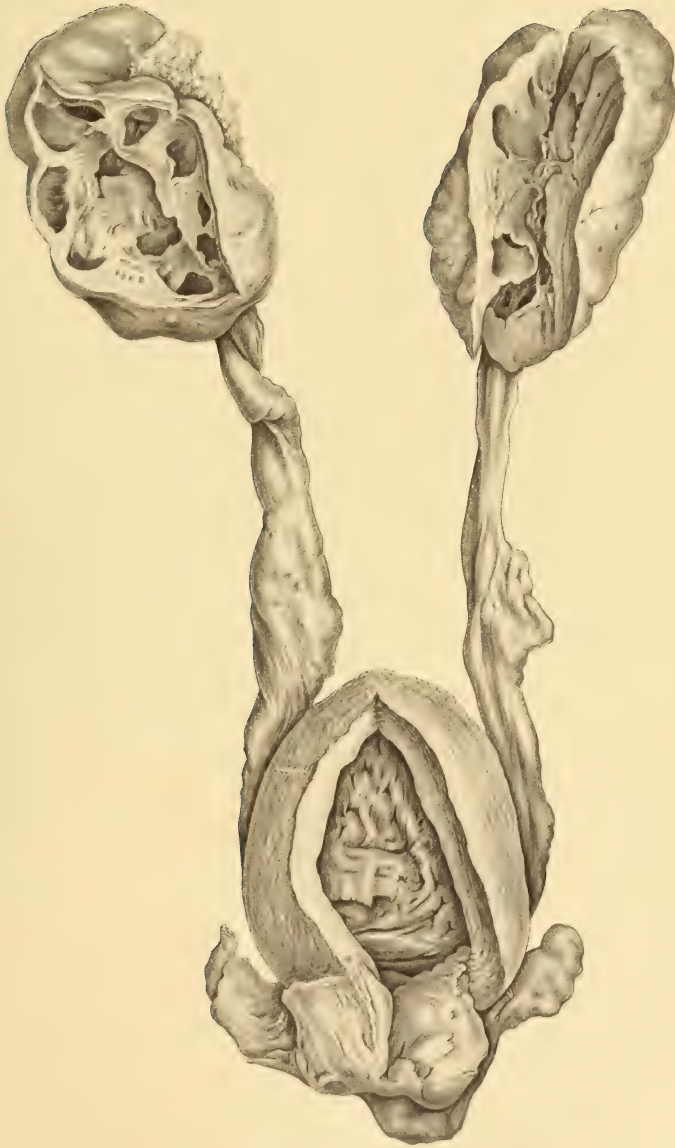
DILATATION OF THE URETERS AND HYDRONEPHROSIS FROM LONG-STANDING PROSTATIC
OBSTRUCTION.
(From a specimen in the Museum of the Pennsylvania Hospital.)

enlargement; obstipation is favoured, and this again reacts for evil by increasing the tendency to piles.

Prolapsus is liable to follow in the wake of these other troubles, both from the straining in the efforts to empty the bladder, and from the hæmorrhoidal condition of the rectum itself.

Pelvic congestion is favoured by nearly every circumstance —especially by the condition of the patient's heart, kidneys, and liver, which have all of them, as a rule, begun to show the fibrosis of age; as well as by the prostatic changes produced by whatever cause.

CHAPTER V.

CLINICAL CAUSES: RACE, AGE, OCCUPATION, SOCIAL HABITS, PREVIOUS DISEASES.

Since there is very little accurately known of the causes of enlargement of the prostate, it is impossible to altogether avoid theorizing in their discussion. Not until large numbers of cases have been collected, in which the patient's previous history has been studied in considerable detail, can we hope to reach any definite conclusions as to the influences exerted by occupation, personal habits, previous diseases of the generative organs, and similar possible causes.

Race.—It does not appear probable that race *per se*—that is, apart from the personal habits characteristic of any particular race—exerts special influence in predisposing to the disease in question.

The negro race has been held to be rather less predisposed to this affection than is the white. Conner [52] expressed this opinion; Schultz I believe has made a similar statement; but the opinions of both surgeons appear to have been based on general impressions rather than on accurate records, and must hence be accepted somewhat guardedly. My own impression agrees entirely with theirs, and is based on no more substantial grounds. The well-known salaciousness of the negro, however, should, if all theories be correct, render him rather more liable to prostatic enlargement than the white man; since it is held, and with apparent reason, that prostatic overstrain and former inflammations of the gland are among the most probable of causes for its overgrowth.

In natives of India there is probably little doubt that pros-

tatic enlargement is abnormally frequent. Wanless [241] has given considerable attention to this matter, and his experience shows that enlargement of the prostate with complete retention of urine is quite common in that country.   He is of the opinion that the chief cause lies in the excessive sexual excitement, "for the reason that sexual intercourse is begun earlier and continued later in life than   .   .   .   in western countries."   Among other possible causes, he mentions the excessive use of curry and hot spices, so common to Indians.   These condiments produce, by their habitual use, constipation and engorgement of the portal circulation; and thus a chronic congestion of the hæmorrhoidal vessels arises, which, as already pointed out in these pages, tends to impede the circulation in the varicose prostatic plexus.   The complete urinary retention which he observed so often in India occurred chiefly at the time of the monsoon rains, when exposure and chilling were almost unavoidable; and in practically every case of urinary retention the cause was prostatic obstruction.   Still another cause, and one which favoured the formation of phosphatic calculus, was the concentration of the urine due to prolonged work under the hot tropical sun; so much of the bodily fluids being thrown off by the sweat glands that the urine excreted was abnormally concentrated.

In Turkey, also, prostatic troubles are comparatively frequent, chiefly due, according to Wishard [252], to the excessive sexual activity.   In China and Japan, however, they are considered to be extremely rare; but not probably on account alone of the absence of the same exciting cause.

Age.—Age appears to exert a marked influence, although it is not any longer regarded as a cause *sine qua non*.   More and more it is becoming recognized that it is not the prostatic enlargement which developes first in old age, but that it is the symptoms of this disease which begin to manifest themselves only in the decline of life.   Some fifty years ago or more prostatic troubles in men under sixty years of age were next to unknown.   Sir

Henry Thompson [224] stated that enlargement of the prostate never occurred under fifty-three years of age; but McGill [152] operated on two men, aged fifty-three and fifty-four years respectively, in whom enlargement must have existed for some time before the patients were seen by him.   McGill [153] later reported another patient in whom enlargement existed at thirty-five years.   Moullin [176] mentions the age of one of his patients as forty-nine years, and refers to one of Henderson's patients aged forty-eight years, and to other patients of forty-one and thirty-six years; while Dr. Mudd [179, 180] reported cases occurring in a young negro of twenty-seven, in a child of five years, and in an infant of thirteen months.   But in spite of these unique examples, the fact remains that symptoms due to enlargement of the prostate under fifty years of age are very seldom observed. The researches of Thompson [224], Dittel [68], and others have shown that appreciable enlargement exists in about one-third of persons over sixty years of age, but that it produces manifest symptoms in only one out of every twenty.   When the seventieth year has passed without enlargement of the prostate, subsequent trouble from it is very unusual.   Prof. Humphrey [127] stated that only seventeen out of seventy-two patients between the ages of eighty and ninety years, and only one out of thirty patients over ninety years, presented symptoms of prostatic enlargement.

Hunter McGuire [156] held that while enlargement of the prostate might exist in younger men, yet that symptoms were not manifested until the urinary tract, in company with the rest of the body, showed the results of senile changes.   Such an explanation as this is in accord with the fact that natives of India and other tropical countries, as a rule, show symptoms of prostatic enlargement some fifteen or twenty years earlier than do the inhabitants of more temperate climes, their span of life being that much shorter than ours.

Occupation.—It is not probable that occupation exerts very

much influence over the developement of prostatic troubles. Some of the earlier writers thought that excessive horseback-riding caused enlargement of the prostate; and in more recent times bicycle-riding, especially with the seat high and the handle-bar low, has been held responsible for the production of this condition in certain patients. Probably of more real ætiological value in this respect than such direct causes are factors which exert their influence indirectly, such as a sedentary life, or other habits which predispose to pelvic congestion.

Social Habits.—Under the title of "high living" may be grouped a certain number of influences which undoubtedly make the patient prone to prostatic troubles. The gouty, the rheumatic, the lithæmic; the man with hepatic and portal congestion, with a tendency to hæmorrhoids, or to varicose veins of the legs, is a not unfrequent victim of enlarged prostate; and thus, as Wanless [241] has pointed out, in the case of the Indian noted above, dietetic habits or errors may become potent though indirect causes of enlargement of the prostate gland. In many respects the causes of this malady and those predisposing to the formation of vesical calculus are the same, and the concurrence of the two affections is frequent.

Over-indulgence in sexual intercourse has long been considered a possible factor. From the enlarged and tender prostate of the young masturbator, to the similar organ of the old man who marries a young wife,—it has been common to blame the sexual excitement as the efficient cause; but, as remarked by J. William White [247] it is probably quite as logical, if not more so, to blame the enlarged prostate with exciting unnatural desires. In accord with this view is the recommendation of Tobin [229], who regards persistence of sexual desires in old men as an indication for double castration. Lydston [149] teaches that enlargement of the prostate is in great part due to its "overstrain," which he defines as hyperfunctional activity of the organ; this overstrain, he thinks, may have occurred in

early or middle life (from prostatitis, urethritis, congestions from masturbation or ungratified sexual desires, etc.), and yet may not show itself until past middle life, when a general sclerotic tendency arises—as an old injury to the knee, for example, will only begin to give permanent symptoms when gout, rheumatism, arthritis deformans, or some similar disease makes its appearance. Harrison [116], arguing along lines somewhat opposed to the overstrain theory of Lydston, said: "That the withdrawal of a portion of that function of the prostate in which it has been the most actively engaged, should be followed by a continued activity in which growth is substituted for secretion, is not, I consider, pathologically illogical." But Hodgson [122], on the other hand, thought the enlargement might well be due to the necessity which the prostate was under of supplying a fluid for sexual intercourse after the secretion of the testicles had become insufficient for that purpose.

The whole subject of the relations of the testicles to the prostate is quite obscure, and many very contradictory and apparently irreconcilable facts are at hand. The testicles undoubtedly furnish to the œconomy an internal secretion, the action of which at the advent of puberty produces the sexual characteristics of the individual. If the testicles are removed before puberty, the boy remains of neutral sexual characteristics, and the prostate and seminal vesicles fail to develope. If the testicles are removed after puberty, the sexual characteristics which were then acquired do not disappear, but in some instances atrophy of the prostate and seminal vesicles occurs. Cryptorchism in no way prevents the developement of the sexual characteristics, showing that these depend upon the internal secretion of the testicles for their manifestation, and not upon the power of procreation possessed by the individual. From certain observations it seems probable that the prostate is more closely connected with the epididymis and the vas deferens than with the testicle, since some persons have been observed with two normal testicles, but with an

undeveloped vas deferens on one side, the corresponding half of
the prostate being rudimentary.   Likewise a unilateral develope-
ment of the prostate has been noticed where the kidney and
ureter on the same side were absent.   Remete [198] is of the
opinion that only normal prostates are caused to atrophy by cas-
tration; and that the more hypertrophied a prostate is, the less
likely is castration to produce any beneficial effect upon it.   It
is certainly true that removal of one testicle does not usually
cause atrophy of the corresponding half of the prostate, even
when this latter organ is normal.   Moreover, Moses [172] has
observed a case in which prostatic enlargement developed for
the first time some years after double castration.   MacEwen
[151], similarly, advocated the theory that the testicles furnished
an internal secretion which regulated the growth of the prostate,
and that enlargement occurred when the testicular atrophy of
age caused this influence to be in abeyance.   Under such teach-
ings castration as a remedial measure would be preposterous
in the extreme.   It is interesting to note the observations of
Ciechanowski [50] in this connection.   He showed that dogs are
the only domestic animals which have an infectious urethritis.   It
is well known that of all animals dogs are most prone to enlarge-
ment of the prostate.   Moreover, in other animals castration
invariably causes prostatic atrophy, but in dogs it often fails to
produce any beneficial influence.

If the influential internal secretion comes from the testicles,
it is difficult to see how ligation or excision of a part of the sper-
matic cords or vasa deferentia could cause atrophy of the pro-
state, unless it were by first producing a change in the testicles
themselves; indeed, it seems not impossible that the atrophy
is due entirely to the physiological rest which is obtained for
the prostate through the absence of sexual desire.   But, on the
other hand, it must be remembered that castration does not
always cause a loss of sexual desire.   Mere subsidence of con-
gestion is a much more usual result of castration than is actual

atrophy; and the return of voluntary micturition within a few hours after orchidectomy only shows, in my opinion, that other manners of relieving the prostatic congestion would have had a similar effect. A further fact in favour of physiological rest being the cause of prostatic atrophy, however its action is obtained, is the observation of Hodgson [122] of a patient, aged thirty-five years, whose penis had been amputated some years before his death: in this case the autopsy showed the prostate, the seminal vesicles, and the testicles all much reduced in size.

All these considerations really bring us back to the proposition with which we started, that excessive sexual intercourse is a frequent cause of enlargement of the prostate gland. It is not, however, the only cause, nor in all probability the most important one. This affection, as is well known, has at times afflicted the most moral and continent of men.

Previous Diseases.—Probably the most prevalent of all causes is a preceding inflammation of some kind. The views of Ciechanowski [49, 50], of Greene and Brooks [102], and of Crandon [54] on this subject have already been discussed, and a mere reference to the question is here required. Naturally the most frequent of these inflammations is the gonorrhœal; and although many patients of over sixty years may have forgotten it, or may be unwilling to acknowledge it, yet a negative history in this respect cannot carry too much weight. Even if the inflammation of the deep urethra and the prostate have not been of gonorrhœal origin, the repeated attacks of congestion and the catarrhal exudation, from whatever cause, which frequently occur in this part of the human frame, are a quite sufficient cause in the majority of instances.

Stricture of the urethra has been thought by some authors to rather militate against prostatic obstruction, from the increased fluid pressure which exists behind the seat of stricture tending to dilate the prostatic urethra. Yet a stricture of some size is present in many cases of enlarged prostate. I have obtained

a history of gonorrhœal infection or have noted the presence of strictures in four out of eighteen cases; and in only three of the remaining fourteen cases was it noted that venereal history was positively denied.

Other diseases may act as predisposing causes. Among these, arterio-sclerosis is prominent in the nosological tables of the French school. Other affections, such as cardiac insufficiency, hepatic cirrhosis, or other diseases which cause congestion of the pelvic organs, should also be considered; but their action is very indirect, and may be a mere coincidence, not an actual cause.

CHAPTER VI.

SUBJECTIVE SYMPTOMS.

Not every patient with enlargement of the prostate presents symptoms of his malady. Only about one person among every seven who has an enlarged prostate suffers from it; and even among the number who do develope symptoms there are many in whom these begin so insidiously that the patients will perhaps be unaware of any deviation from the normal until acute retention of urine occurs from some access of obstruction, or until overflow relieves the unperceived chronic retention. The affection, on the other hand, while gradual in onset, may yet make its presence felt by symptoms which arrest the patient's attention from the first.

Some change in the urinary function is almost invariably that which is earliest observed, and usually consists in an increased frequency of micturition. This, if it occurred only during the day, might easily escape notice; but since it is present at night as well, and compels the patient to arise once or oftener from his sleep, is a change which is very soon observed, and for which an explanation is usually promptly sought. Especially with younger patients is this true; among the old a not unnatural idea exists that frequency of urination is one of the signs of age, and is therefore rather to be anticipated.

Frequency of urination is due mainly to two causes: first and foremost, because the congestion or inflammation of the vesical neck and the parts around the prostate renders the bladder more sensitive to the presence of urine, and hence less able to support a large volume of fluid; and, second, because residual urine lessens the capacity of the bladder, which as a consequence

reaches its usual grade of distention at shorter intervals. Besides these factors, the quality of the urine is often exceedingly irritating, and so its expulsion is demanded more frequently.

Many authors have taught that the frequency of urination was greater at night than during the day; but, apart from the lack of reason for this phenomenon, I doubt its being a fact. Greater stress is laid upon nocturnal frequency by the patient, and consequently in many cases by the surgeon, merely because it arrests the attention sooner than increased frequency of urination by day. A man may wash his hands eight or ten times during the day, and think nothing of it; but if he was to wake during the night with an irresistible desire to get up and wash his hands, he would be very sure to remember the fact in the morning, and to seek for an explanation. This is an extreme comparison, but serves to show how much more importance is attached by some to nocturnal frequency, than to that occurring during the day. These patients are not inclined to urinate oftener while recumbent in day-time, so the horizontal position cannot be given as a cause for greater frequency by night. Sleep may possibly be the factor of greatest importance, by lessening the power of inhibition over the involuntary sphincter, and by unconsciously increasing the resistance of the voluntary sphincter: thus when the patient finally wakes, his bladder is fuller, because a longer interval has elapsed since it was last emptied, than is the case during the day; and after this first sound sleep of a few hours, the bladder has been rendered so irritable by overdistention that calls to urinate occur with greater frequency during the remainder of the night. This is given as a possible explanation by Moullin [176]; and it appears to be a fact that the first interval at night is the longest. Other explanations of nocturnal frequency have been given, such as sexual emotions during sleep; but it is probable that these are as much a consequence as a cause.

Of course, when cystitis develops this in itself causes the

desire for urination to be more frequent; and where ulceration
or fissure of the bladder exists, the vesical tenesmus may be con-
stant and uncontrollable.

The patient is likewise unable to expel the urine with his
accustomed force. *Starting the stream is difficult,* much strain-
ing being required, because there is both increased obstruction
and decreased expulsive power. When started, the stream does
not spurt forth in the normal parabolic curve, but tends to *drop
vertically from the meatus.* A longer time than usual is required
to pass the urine, although a smaller quantity than normal is
passed, since the intervals are less and some residual urine
remains. The stream is not smaller than in health, unless stric-
ture causes it to be so.

As the act of urination draws to a close, *the urine dribbles
involuntarily.* It will thus often wet the patient's shoes; so that
if there be much sediment present, these spots on drying will
be incrusted with salt; from this fact alone a tentative diagnosis
may be made. The cause of the dribbling, without the power
being present of evacuating the last drops in spurts, probably
lies in the impaired contractility of the bladder, which fails to
send forward into the membranous and bulbous urethra a suffi-
cient quantity of urine for the voluntary muscles to contract
upon. The prostatic urethra, moreover, is unable to put itself
into physiological continuity with the bladder, and acting as a
more or less rigid tube, interferes with the normal flow.

Intermittent urination has been described as present in some
cases, but is very rare. It may be due to the ball-valve action
of a prostatic outgrowth, which is more tightly forced against
the vesical outlet the more forcefully the bladder contracts, and
which permits urination only when it is floated back from the
orifice of the urethra, during intervals of straining. If not due
to such a cause as this, the ordinary "stammering with the
urinary organs," as Sir James Paget [188, p. 57] termed it, affords
a sufficient explanation. The presence of a calculus might also
act in this way.

Retention of urine is observed by the patient only when acute, or when the chronic form is accompanied by overflow. By far the most frequent cause of acute retention in these cases is an access of congestion in the vesical neck. A man who very likely had thought himself previously perfectly healthy will attend some party of pleasure, eat and perhaps drink more than he is in the habit of doing, be exposed to draughts, become overheated, or in some way commit an indiscretion; and on his return home will find himself unable to pass his urine. When relieved by catheterization, a similar event may not occur for months or years, perhaps never again.

Overflow from retention is in some instances the symptom which first attracts the patient's attention. When the bladder has reached its limit of distensibility, as soon as any urine is received from the ureters, an equal amount must be discharged by the urethra. This involuntary leakage may be noticeable first only at night, when the influence of the will is withdrawn, or by day only during the effort of lifting some heavy object, in stooping to pick something from the floor, or during defæcation —all these acts necessitating contraction of the abdominal muscles, and hence diminution in bladder capacity. At later stages this overflow becomes a constant symptom, and unless relieved the patient must wear a urinal, or have his clothing constantly wet. The odour attendant upon this condition will frequently, in the poorer class of patients, at once direct attention to the true state of affairs.

As previously pointed out, this symptom is much more frequent where there is no cystitis. The probable explanation is that no catheter has ever been passed to relieve the bladder of its residual urine, and to prevent its walls from losing their muscular tone through overdistention; and that since no catheter has been passed, no cystitis has developed.

Incontinence of urine is extremely unusual. It has often been supposed to be present when the true condition was that just

described—overflow from retention. Prof. Ashhurst [9] in his Surgery states that he "once saw a patient who, supposed to have paralysis of the bladder, had been taking strychnia for *one year;* the introduction of a catheter effected the evacuation of nearly a quart of urine, and showed the real condition to be one of prostatic retention with overflow." If true incontinence of urine does exist, it may readily be determined by catheterization, when the bladder will be found empty. It is probably due, when present, to a form of prostatic overgrowth which keeps the vesical orifice of the urethra constantly patent, and to inability of the voluntary sphincter to properly contract. In the normal condition as soon as urine enters the prostatic urethra, desire for micturition is present; and where urine is constantly in this portion of the urethra, a constant effort of the will is required to avoid its passage. Hence, even if the voluntary sphincter can act normally during the day-time, incontinence will be present in these cases during sleep, except where the elastic resistance of the urethra is stronger than the contraction of the bladder walls. But, as a rule, when true incontinence occurs at all, it is present throughout the twenty-four hours.

The symptoms of *cystitis* arising in a patient with enlarged prostate are the same as those in other cases of cystitis, and do not require extended mention in a work of this kind. Cystitis in these cases is practically never caused in any other way than by catheterization. It is theoretically possible for bacteria to gain entrance to the bladder in other ways, as through the kidneys, directly from the rectum, and by extension along the urethra. When gonorrhœa is the cause, this last route is not unfrequent, but even then the gonococci are more apt to be carried back to the bladder by a catheter than to travel there of their own accord.

Urination which was frequent before, becomes doubly so when cystitis developes; tenesmus is more pronounced, and the relief obtained by the partial evacuation is slight. A heaviness and

burning may be felt in the perineum; suprapubic pain may be marked; or the most infernal of all tortures, the burning, boring, uncontrollable pain in the neck of the bladder, may render the patient nearly insane. Pus, mucus, and blood may all be observed by the patient in his urine.

Hæmaturia, though not one of the most prominent symptoms, is met with sufficiently often to command the surgeon's particular attention. It may be due to the spontaneous rupture of varicose urethral or vesical veins, may be produced in certain instances by the most gentle catheterization, or may come from ulceration due to the prolonged cystitis or to calculus. In cases of marked obstruction the patient after persistent straining may relieve himself of only a few drops of blood. In such cases the blood probably comes from congested veins. If the blood is mixed with the urine as it flows, it probably comes from the prostate or the neck of the bladder, and may flow from an ulcer or a ruptured blood vessel. If it flows only at the close of urination, and particularly if it is clotted, it is apt to come from the post-prostatic pouch of the bladder.

Symptoms of renal failure may arise at various stages of the disease. Nephritis may, of course, be an independent affection; but if not already present, is usually manifest very soon after the quantity of residual urine becomes great, or when infection of the bladder causes retrograde pyelitis. The patient may notice that he not only passes urine more frequently, but that the total quantity passed is greater, and that he is unaccountably thirsty. This increase in quantity is one of the earliest evidences of impairment of the kidneys, and should be carefully noted. If complete retention occurs in such cases, uræmia may rapidly supervene, from the inability of the kidneys in their diseased state to excrete under increased pressure the toxic matters whose retention in the blood gives rise to the well-known symptoms: confusion and anxiety of mind, dyspnœa, dry burning skin, feverish eye, parched tongue, urinous odour to the breath, hiccough and vomiting,

somnolence and coma, convulsions, and death. If pyelitis be present from infection, irregularly recurring chills, with fever and sweats, may be added to the above train of symptoms.

Closely following upon the heels of renal involvement, certain *cardiac symptoms* may appear—slight dropsy in the ankles or the hands, shortness of breath on exertion; palpitations; loss of appetite from gastric congestion; and other symptoms too generally recognized to need repetition here.

Sexual power is usually lost if the prostatic disease be far advanced; in earlier stages intercourse may be painful, pain being marked especially after completion of the act. Not unfrequently the sexual appetite is abnormally active, and distressing priapism may occur.

If the prostate enlarges much towards the rectum, certain additional symptoms may be noted by the patient. Both *constipation* and *obstipation* may arise; and the constant straining to urinate or defæcate may produce *hæmorrhoids*, and even *prolapsus ani*, as in the case of children straining on account of vesical calculus. It is in this form of enlargement, too, that the fullness and uncomfortable feeling in the perineum, so often complained of, are chiefly found.

If *calculi* form in the bladder, some special symptoms of this malady may be noted; but, as a rule, they are subordinated to the peculiar prostatic symptoms, since the stone is held fairly firmly in the post-prostatic pouch, or in one of the mucous pouches of the bladder.

To attempt clinical pictures of patients suffering from enlargement of the prostate, by dividing the disease into certain stages, is a rather arduous task, since the duration of any one symptom or set of symptoms varies exceedingly in different individuals. Perhaps as just an appreciation as any of this view of prostatic enlargement may be reached by grouping the patients into three classes, in the first of which, the earliest stage, may

be placed those patients whose chief complaint is nocturnal frequency of urination; in the second stage those patients who suffer occasionally from complete retention, but whose cystitis is insignificant, and whose general health is fairly good; and in the third class those wretched individuals whose retention is nearly absolute or quite so, who depend entirely on catheterization, whose kidneys are markedly diseased, and whose general health is on the verge of collapse.

Some patients will remain in the first stage all their lives; some will within a few months pass into the second stage; and others will seemingly jump at once from the first to the third stage with scarcely an appreciable sojourn in the second.

Some patients, on the other hand, will never be conscious of having passed through the first stage, but will first be impelled to seek medical aid for sudden retention of urine; and may then, if fortunate, return to the first stage and remain there all their lives. In many instances patients who reach the second stage without having been aware of the first will remain in the second stage throughout their lives; but in very rare instances only do patients pass at once from a life of seemingly perfect health to one of absolute and complete catheterism.

The surgeon should, above all things, bear in mind that a positive diagnosis of enlargement of the prostate can never be made from the symptoms alone: a physical examination is absolutely essential.

CHAPTER VII.

OBJECTIVE SYMPTOMS—PHYSICAL EXAMINATION.

When a patient, suspected from the symptoms he describes to be suffering from enlargement of the prostate gland, presents himself to the surgeon, the first and most important physical sign to be looked for is the presence of a hypogastric tumor, with the characteristics of a distended bladder. Important as it is in all cases, it is above all in those patients who have been afflicted with chronic urinary retention and overflow that this precaution is indispensable. In patients such as these the hasty introduction of a catheter may cause immediate syncope, from the decrease of intra-abdominal pressure, and may lead, in a few days, to the patient's death from renal congestion and uræmia. I am well aware that Dr. Cabot's [41] recently reported experiences are at seeming variance with this time-honoured doctrine; but in the cases he reported continuous bladder drainage was instituted in patients such as those now under discussion with chronic retention and overflow; and the happy results in his hands may have been due to the facts that the drainage was constant, not intermittent, and that the patients were kept under careful constitutional regimen. But to regardlessly plunge a catheter into such bladders in our office, or at a hospital dispensary, where the patients are not provided with the requisite facilities for proper after-treatment, will, I venture to think, ever remain a most dangerous and unsurgical procedure.

Having detected such a hypogastric tumor, or having ascertained its absence, the patient should next be requested to urinate. We may then observe the facility, or the difficulty, with which he starts the stream; the force with which it is ex-

pelled from the bladder; its size, as indicative of stricture or not; whether it is suddenly interrupted at any time, showing the possible ball-valve action of a pedunculated "middle lobe," or of a calculus; and whether he concludes the urinary act in the normal manner, or if the last portions dribble out of his urethra without voluntary control. From a strict attention to these details—and no details are too insignificant in urinary affections —much may be learned that will prove of subsequent interest. The quantity of the urine just passed is then to be measured, and a portion of it preserved for chemical and microscopical examination. Its colour, odour, and the presence or absence of sediment, as roughly gauged by the eye, will be of immediate use to us in approximating the condition of the bladder and the kidneys. By learning the interval since the last urination, and knowing the quantity just passed, we may form an estimate of the total quantity passed in twenty-four hours; and if the amount of residual urine be fairly constant, this quantity serves as an index to the action of the kidneys. A patient who passes four ounces of urine, more or less, every two hours has probably no serious renal lesions. If he passes four ounces only every three or four hours, either the normal amount is not excreted by the kidneys, or else the quantity of residual urine is rapidly increasing. If, on the other hand, from a half ounce to an ounce is passed every ten or fifteen minutes, the patient's kidneys will be excreting from fifty to one hundred and fifty ounces of urine daily, and retention with overflow probably exists.

If it appears that the bladder is not distended, it will then be proper and convenient to insert a catheter to determine the amount of the residual urine, and to aid in palpation of the prostate. For these manipulations the patient should be in the horizontal position.

In many cases the surgeon will be forced to try several catheters before he will succeed in reaching the bladder. Where possible, for diagnostic purposes only, I prefer a metal instru-

ment, about number twenty of the French scale. I say for diag-
nostic purposes only. For habitual use in these cases I do not
think metallic catheters are advisable; but for the first examina-
tion they present many obvious advantages, such as the ease with
which they are sterilized by being passed through the flame
of an alcohol lamp, or by igniting alcohol which has been poured
over them; the fact that the surgeon need touch them only at
the extremity which does not enter the bladder; and finally,
what is of great importance, that they serve as an exploratory
sound both in the urethra and within the bladder. I have little
doubt that many a soft-rubber catheter which is as pure as the
new-fallen snow when taken into the hands, becomes oftentimes
foully contaminated by the manipulations that are necessary
for its insertion into and passage through the urethra.

As this metallic catheter passes, the surgeon should note the
presence or absence of strictures, any deviation from the normal
line of the subpubic urethra, the height to which its vesical
orifice is raised, and lastly the distance from the urinary meatus
at which urine first begins to flow.

In passing the catheter the following facts favour the diag-
nosis of enlarged prostate: if it is found that the shaft has to
be unduly depressed between the patient's legs before any urine
flows, showing that the vesical orifice of the urethra is raised;
if the urinary distance (that from the meatus to the point at which
urine commences to flow through the catheter) is increased above
eight inches; if the catheter deviates towards one or the other
side as it passes through the prostatic urethra, showing an in-
equality in size of the two lateral lobes; or, finally, if an obstruc-
tion to the passage of the catheter is encountered at a distance
of more than seven inches from the meatus, showing that the
obstruction is not due to strictures, which are never present
in the prostatic urethra.

The surgeon should not be deceived into thinking the bladder
has been reached when a small quantity of urine is evacuated

from an enlarged prostatic urethra. It will be remembered that this portion of the urethra may at times hold as much as an ounce or two of urine.

The bladder having been reached with the catheter, the residual urine will flow. If it flows through the catheter without effort on the patient's part, it indicates a fairly good vesical tone; but if even with the aid of his abdominal muscles the patient cannot expel the residual urine, and only by suprapubic pressure with the surgeon's hand can this be made to flow, it is evident that atony of the bladder is far advanced.

The amount and the character of the residual urine will then be noted. From it much more accurately than from that passed voluntarily can the state of the bladder be inferred. Some sediment will almost invariably be evacuated. If much is present, it is probable that catheterization has often been resorted to before, and that a more or less marked cystitis exists. Clots of blood are frequently found. Possibly some calcareous sediment will exist. The odour of the residual urine is usually ammoniacal. But apart from the fact of there being residual urine, its quality does not aid the diagnosis of enlarged prostate, merely showing the grade of cystitis present.

It is next well to inject a few ounces of warm boric acid or saline solution, to hold the walls of the bladder away from the beak of the catheter. By the resistance encountered during the injection an idea of the condition of the bladder walls—whether dilated or contracted—can be obtained.

Using the metallic catheter with all gentleness, then, as a sound, we can detect the approximate amount of intravesical enlargement of the prostate; the quality of the bladder walls, whether flabby and dilated, or thick, rugous, and pouched; the existence of calcareous crusts on the surface of the bladder, and of a calculus in the post-prostatic pouch, or in one of the vesical sacculi.

The surgeon should next, without removing the catheter,

introduce a finger of the left hand into the patient's rectum. In doing this it is usually more convenient to stand on the patient's left side, and to manipulate the catheter or the sound with the right hand. By this method of combined examination it will be possible in every case to detect positively any enlargement of the prostate. The intravesical instrument is to be regarded merely as a very long finger, and the amount of information that can be gained through it by an experienced surgeon will be a matter of astonishment to the tyro.

The examining finger is not to be thrust blindly and suddenly into the rectum—such a procedure is both painful and dangerous, since hæmorrhoids with considerable proctitis may be present; but by a very gradual and gentle boring motion the finger may be insinuated so as to cause the patient very little discomfort. As the finger passes the sphincter we can feel the catheter in the bulbous urethra, then can trace it back into the membranous urethra, but in case the prostate is enlarged it will be impossible to trace it further. The finger next encounters the prostate in the anterior rectal wall, and, passing to either side, towards the ischial tuberosities, the outline of the enlarged lateral lobes can be detected. In most cases it will require a long finger to reach well beyond the enlarged prostate, and to feel the tip of the catheter in the retro-prostatic pouch; but this should always be attempted, as we thus obtain a very much more accurate idea of the size and shape of the prostate; and where the beak of the catheter is not long enough to reach the floor of the pouch, it may be possible to elevate this by the finger in the rectum, and thus to detect a calculus which might otherwise have escaped notice. By directing the patient to close his mouth and "bear down," the prostate may be forced into reach of the finger even when very much enlarged.

Before withdrawing the finger the state of the seminal vesicles should be examined if they are within reach. The existence of high internal hemorrhoids can also be determined.

PLATE LIX.
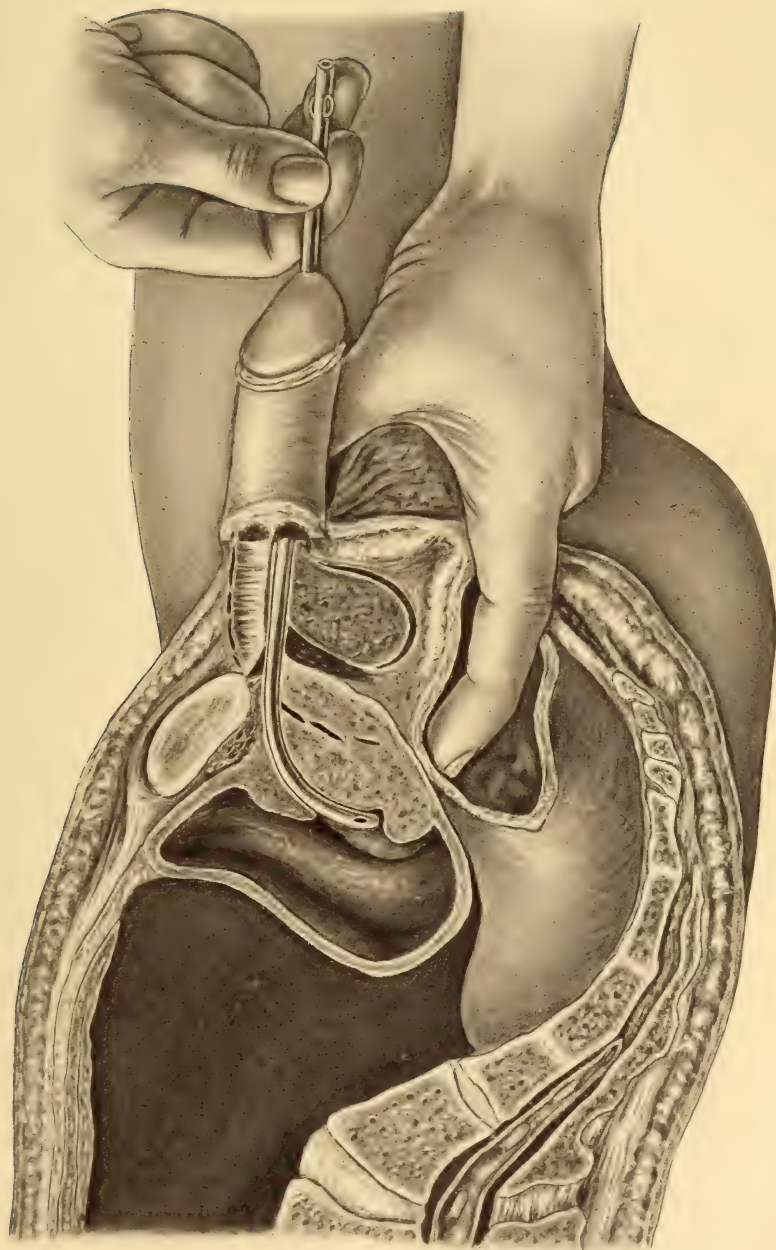
COMBINED EXAMINATION, WITH A CATHETER IN THE BLADDER, AND A FINGER IN THE RECTUM.

If it has been impossible to satisfactorily examine the rectal relations of the prostate on account of its size or its high position in the pelvis, an assistant may be able, by well regulated but firm suprapubic pressure, to bring it within reach of the palpating finger; or it may be gently drawn down by the aid of the catheter within the bladder.

Such an examination as this will enable us to say positively in every case whether there is or is not an enlarged prostate. The surgeon should remember, however, that many symptoms of enlargement of the prostate may exist without there being any enlargement present; and that enlargement of the prostate may exist and yet give rise to no symptoms; and, furthermore, that even where characteristic symptoms and prostatic enlargement are both found, one is not necessarily caused by the other. Hence no surgeon should undertake any plan of treatment hastily, or without due consideration in cases of this kind. Indeed, it is often best to temporize for awhile, until by making repeated and careful examinations all possible sources of error have been eliminated, and the condition of the parts involved has become familiar to the surgeon.

In the local examination such as has been described, it has been assumed that the urethra was freely open to instrumentation; but in very many patients this is not the case: strictures, false passages, and obstruction by the prostate itself may any or all of them render such an examination impossible; and hence oftentimes the best that can be done is to improve the condition of the urethra, and so persist until a satisfactory examination finally becomes possible. Enlargement of the prostate is not a disease in which haste is advisable.

Besides the condition of the urinary tract, the surgeon should always make a thorough general physical examination. The signs of age, whether premature or not, should be sought for: the condition of the arteries, the arcus senilis, the cardiac action, and the general circulation all require attention. The general

health should be determined—the appetite, the habits as to smoking and drinking, the digestion, the amount of sleep usually obtained, and the ability to pursue the usual occupation—none of these should be neglected.   The state of the heart and kidneys is of the utmost importance: increased renal pressure and the consequent toxæmia so soon make their presence known by cardiac hypertrophy, with increase in size of the left ventricle, evidenced by displacement of the apex-beat downwards and to the left, and by the stronger and longer first cardiac sound in the same situation, with the well-known accentuated second aortic sound; that any surgeon who pretends to accuracy in diagnosis would be guilty of great oversight if he neglected a careful examination of the heart.   Of even greater importance than the detection of cardiac hypertrophy, is it to discover the early signs of dilatation of the heart.   It is probable that the accentuation of the second aortic sound above referred to is not an early sign of hypertrophy, so that where it has existed for some time, the evidences of dilatation may be shortly expected; here the weakening of the first apical sound, with the production of a mitral systolic murmur, and increase of cardiac area to the right of the sternum, with perhaps occasional murmurs of incompetency over the aortic valves, I regard as the most valuable local signs.   But as further evidences of cardiac dilatation I would call special attention to the various results of venous congestion, such as dyspnœa, œdema of the extremities, varicose veins, hæmorrhoids, hepatic and gastric congestion, loss of appetite, and flatulency with indigestion.

The chief means we have for determining the condition of the kidneys is, of course, by means of urinalysis.   Without pretending to deny the value of microscopical examination of the urine, I am free to confess that I place much more reliance on the total quantity excreted in twenty-four hours, on the specific gravity, and on the percentage of uræa present, than I do on the presence of tube casts or albumen.   These latter, unless in excessive

amount, I have come to regard as nearly normal in persons past middle life; but where the excretion of solids, as shown by the uræa content, is diminished, and where the total amount of urine excreted is constantly much above the normal, I am far more chary of undertaking serious operative measures than in the former case.

The normal amount of urine excreted in twenty-four hours is from forty to fifty ounces (1200 to 1500 cc.); the normal amount of uræa in the same period is five hundred grains or over (35 grammes); and the normal specific gravity is 1017. Naturally, where the total quantity of urine is increased, unless an increase in the amount of uræa excreted occurs, the specific gravity will be decreased; hence it is not sufficient to calculate the amount of the uræa present from a single specimen of urine: the whole quantity passed in twenty-four hours must be considered. The normal percentage (2.8 per cent.) of uræa may be much decreased, with the increased quantity of urine excreted, yet the kidneys cannot be seriously impaired if the total amount of uræa eliminated remains nearly normal.

An examination of the blood will be of interest; though it cannot be expected to aid in the diagnosis. The percentage of hæmoglobin is the most important point to be determined, since by it we gain a fairly accurate index of the patient's ability to withstand operative treatment.

CHAPTER VIII.

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS ; PROGNOSIS.

The diagnosis of prostatic enlargement is not usually difficult. In the first place, the clinical history, or the sequence of symptoms, is almost invariably characteristic. The increased frequency of urination, in a patient past the prime of life, will at once direct our attention to the prostate. Retention may have necessitated the passage of a catheter once or oftener. If the retention has been due to strictures, the patient will usually be quite well aware of the fact, and will be more inclined to confess their presence than perhaps a younger man who may have the memory of their onset and early stages more vividly in his mind, and may regard them as more of a reproach.

Many of these patients will have been under treatment by another practitioner, and will know their own malady well, so that frequently the surgeon has only to confirm a diagnosis already made. But it is well not to forget that the previous physician, no matter how high his reputation, may have erred in his diagnosis, and that therefore in enlarged prostate as in other affections it is safe not to take a ready-made diagnosis.

As a rule, the age of the patient and his nocturnal frequency of urination are sufficient to arouse our suspicions. As has been already mentioned, the general aspect of the patient, together with a urinous odour, due to overflow from retention permitting his clothing to be more or less constantly wet, will in some instances enable the acute observer to anticipate the diagnosis even before the patient states his troubles. Even in cases seemingly obscure at first, a detailed history of the case and a com-

plete and strictly systematic physical examination will invariably
enable a correct diagnosis to be made. It is only where small
or impassable strictures prevent instrumental examination of the
vesical surface of the prostate that a diagnosis becomes at times
impossible, unless sufficient enlargement can be felt by the rec-
tum to render an intravesical examination superfluous.

The stage of the disease is usually more easily determined
from the symptoms than from the physical examination. The
most important change in the life-history of these patients is
that produced by cystitis, which unfortunately is nearly
certain to make its appearance sooner or later. Naturally,
the earlier the stage at which prostatics are first seen, the greater
is the hope of cure. When the urine is constantly of a specific
gravity below 1010, the action of the kidneys is manifestly im-
paired, and the disease may be considered quite far advanced.
The longer infection is absent, the longer is the disease apt to
endure in a quiescent state, the patient being troubled mainly
with frequency of urination until the accumulation of residual
urine produces overflow.

The cardinal principle by which we determine the size of any
body is by learning the distance between its surfaces, or its diam-
eter; to accomplish this in the case of an organ situated as is the
prostate, it is absolutely essential to gain entrance to the bladder
superiorly and to the rectum below. It is not sufficient merely
to insert a finger into the rectum and to palpate the prostate
thence; nor is it enough to learn by catheterization that the
urinary distance is increased, that the subpubic urethra deviates
from the normal curve, and that there is residual urine. By the
rectal touch frequently no enlargement can be detected while
decided urinary obstruction exists from overgrowth into the blad-
der or urethra; and the information gained from the passage
of a catheter alone is manifestly incomplete. Hence before mak-
ing a positive diagnosis the surgeon should resort to the com-
bined examination with a sound or catheter within the bladder,
and a finger in the rectum, as already so often insisted upon.

But merely to ascertain that the bulk of the prostate gland is increased is not to make sure the diagnosis of "enlargement of the prostate." Enlargement may exist from various morbid processes, such as chronic prostatitis, prostatic abscess, calculus, or tumors of the prostate; and it is chiefly by attention to the clinical history of the case that a distinction between these different forms of enlargement is reached, although, as will be mentioned under the head of differential diagnosis, the sense of touch will aid us here as well.

I have not heretofore mentioned the cystoscope as an aid to diagnosis, and this omission has been intentional, since I consider this instrument of very little use in the average case, and feel that in some patients its injudicious employment may be productive of harm. Where a satisfactory diagnosis cannot be made without the employment of the cystoscope, the surgeon need not hope to make one by its aid; and under such circumstances it is, in my opinion, quite as well for the experienced surgeon to do either a suprapubic cystotomy or a perineal urethrotomy, and thus to explore the bladder and prostate with the eye which nature has placed at the end of his index finger. In these cases drainage is the all-important indication, and while evil results from over-instrumentation may be few and far between, and while the cystoscope is only slightly more dangerous than an ordinary catheter, yet since so little of value can be gained by its use, it is best to avoid it as a rule. Surgeons there may be, and probably are, who are more expert with complicated machinery than with their hands, and who will always prefer the use of a machine to work performed by their fingers; such operators employ an elaborately complicated needle-holder, a dental engine, a Bottini incisor, or a cystoscope, largely because of their admiration of the mechanical perfections of the instrument in question; and what excuse there is for the habitual use of the cystoscope in the diagnosis of prostatic hypertrophy, is when it is in the hands of those surgeons who employ it daily for other

purposes. To advise the general practitioner, who may have need of a cystoscope only once in five years, to insert it into the distorted, inflamed, and susceptible urethra of prostatics, is to be guilty of great indiscretion, to say the least. It is quite unfortunate enough that an instrument of some kind must be passed to enable us to complete our examination; and it is to avoid repeated instrumentation that I have recommended a metal catheter in the first instance; but we should shun the error of making the remedy worse than the disease.

In my own experience I have rarely learned more from a cystoscopic examination, in any patient, than I knew already, or could accurately infer. The form and shape of the intravesical growth I have been invariably more able to determine from palpation by the aid of a sound or catheter than through the medium of vision by a cystoscope. The employment of the cystoscope, indeed, is only too often like that of the skiagraph at the present day—much abused, and of value chiefly as confirming diagnoses already made.

It is an important thing to be able to distinguish between the two main classes of prostatic overgrowth—the glandular and the fibrous—since the same operation, if one is indicated, is not usually advisable for both varieties.

The prostate which has undergone a change which is chiefly adenomatous in character is larger and less dense than the normal organ, and is usually not firmly fixed, unless its great size make it so; the rectal mucous membrane glides easily over its surface; the general outline of the two lobes and the intervening commissure can often be distinguished; and well-defiend adenomatous masses (prostatic tumors) of greater than the normal density may at times be palpable in the substance of the gland; while the surface may present similar protuberances, sessile or pedunculated.

The bladder in such cases is more apt to be dilated than contracted; cystitis is either slight or absent; and the patient may

reach the stage of retention with overflow before he has observed any marked deviation from his usual health. The duration of the malady and of the frequent urination will usually have been several years at the least.

Where the fibrous prostate has developed, the organ will be but slightly enlarged, or may in rare instances even become smaller than the normal. Its density is increased; periprostatitis as a rule has occurred, causing the formation of fibrous tissue about the prostate, so that it is less movable than normal; the rectal mucous membrane will be less able to glide over the surface of the altered gland; and the outlines of the prostate will be more difficult to determine. No protuberances are, as a rule, to be felt on its surface, and so dense is its whole substance that embedded tumors, if any be present, cannot be detected.

The bladder, in the case of the fibrous prostate, has probably early been exposed to infection: it is found contracted, its walls thickened, and its surface perhaps pouched. As a consequence of this, distressing symptoms have made themselves prominent early in the case; and the patient may give a history of only a few months' or a year's duration; while he next to never reaches the stage of overflow, as the constantly recurring desire for urination has impelled him to keep his bladder nearly empty, by catheterization or otherwise.

It is the contemplation of these two clinical pictures—the one a dilated and passive bladder, the other a contracted, infected, irritable bladder—that makes it seem improbable that the two forms of prostatic disease are due to the same causes: inflammatory action seems so pronounced in the latter class, and so latent in the former.

Differential Diagnosis.

Very many of the symptoms and of the physical signs, as well, presented by prostatics, are known to occur in other affections. Hence it frequently becomes necessary for the surgeon to con-

sider the differential diagnosis of these cases, and at times to form his ideas by the method of exclusion.

Atony of the bladder, being itself often caused by prostatic obstruction, may first claim our attention. The symptoms of this malady, even when produced by another cause, may very closely simulate those attendant upon enlargement of the prostate: thus the patient will find himself required to strain immoderately to start the flow of urine, will be long in emptying his bladder, and may be aware that some portion of his urine constantly remains unevacuated. As a consequence of these changes the frequency of urination may be increased, and it may become impossible to differentiate the two affections from a recital of the symptoms alone. But the surgeon will very easily distinguish mere vesical atony from the train of symptoms and their complications due to prostatic enlargement as soon as he seeks a cause for the symptoms. The history of the patients may be the same, but by simply passing a catheter, and palpating the prostate at the same time from the rectum, enlargement of this organ can be readily excluded. Of course, if the vesical atony be due to stricture, it will not always be possible to make this combined examination, and therefore in those cases we cannot be absolutely sure that prostatic enlargement does not coexist.

Hence where **strictures of the urethra** are present, the exclusion of prostatic hypertrophy is more difficult. Although the age of the patient may render the presence of the latter affection extremely improbable, yet many of the symptoms are the same —slow, difficult urination, with atony of the bladder, as well as, possibly, hæmorrhoids and prolapsus ani. But the passage of an instrument of full size into the urethra will show obstruction more or less complete to exist within seven inches of the meatus; and if entrance to the bladder can be gained, the absence of enlargement of the prostate is readily determined by the combined rectal and vesical examination already described. In case, however, of an impermeable stricture with chronic retention, it

will not be possible to satisfactorily examine the prostate until these conditions are relieved.

Cystitis, when unaccompanied by stricture or prostatic enlargement, is unattended by residual urine, and although the crebruria may simulate that of overflow from retention, this affection is readily proved not to exist by the passage of a catheter; while combined intravesical and rectal examination will reveal a prostate of normal size.

The same remarks apply to the very rare condition, **paralysis of the bladder.** A more common mistake is to suppose that patients suffering from retention with overflow have paralysis of the bladder; it being a sad fact that too many physicians are in the habit of diagnosing the rarest complaint possible, and of overlooking very common causes for the malady of the patient, no matter what it is.

Where a **vesical calculus** exists, it is not liable to be mistaken for an enlarged prostate unless it is both firmly fixed in the neighbourhood of this organ and so thickly coated with mucus that no grating sensation is imparted to the sound. But even under such circumstances there may be no residual urine, which is, as already insisted upon, a nearly invariable accompaniment of every enlarged prostate producing symptoms; and there will probably not be the characteristic change in curve of the subpubic urethra. If the calculus is prostatic, or even if it merely coexists with an enlarged prostate, a positive diagnosis is more difficult. In about one out of four patients, it is to be remembered, a calculus complicates the enlarged prostate. Bleeding is more common in cases of calculus than in those of enlarged prostate alone, and the pain is less constant, and more confined to times when the bladder contracts upon the concretion, or when the patient is actively moving about. The pain frequently radiates to the end of the penis. In uncomplicated prostatic enlargement pain is usually an insignificant symptom. In calculus, moreover, the greatest frequency of micturition is

during the day, and the patients are not apt to be disturbed much at night. A skiagraphic examination will at times detect the presence of a calculus when other means have failed.

Probably the most difficult diagnosis of all is that from **polypoid growths in the bladder,** which when springing from the region of the prostate may very closely simulate a pedunculated "middle lobe" of this organ. But in nearly all forms of vesical tumor other than prostatic, spontaneous hæmorrhage is an early and conspicuous symptom, and is usually not attended by much pain. In most cases, moreover, fragments of the tumor are passed in the urine, so that a microscopical examination may render the true condition of affairs manifest.

Tubercle of the bladder may occasionally simulate enlargement of the prostate by the symptoms it produces. But it probably always coexists with similar disease elsewhere in the body, most often in the epididymis. Hence in doubtful cases this should be recollected, and the spermatic cords and seminal vesicles examined as well. The cystoscope here may be of considerable aid, enabling the surgeon to localize a tuberculous ulcer in the bladder, and thus render it accessible for topical treatment. But it is in precisely such cases as these, where there is hæmorrhage from the ulcer sufficient to cloud the medium, that the cystoscope is most disappointing. If the tuberculous disease affects the prostate, there can usually be detected areas of softening, in the irregularly enlarged organ; and although it might at times seem difficult to distinguish between areas of softening in a prostate somewhat denser than normal (tuberculous disease), and areas of hardening in a rather less dense organ (adenomatous enlargement with prostatic "tumors"), yet other features in the case will usually enable the diagnosis to be made.

Chronic prostatitis usually succeeds upon the **acute form** of the disease, which is sufficiently manifested by its abrupt onset, positive inflammatory character, excessive tenderness on rectal exploration, and by its occurrence, generally as a sequel to gonor-

rhœa, in a younger patient. The chronic inflammation is chiefly characterized by prostatorrhœa, which is very unusual in simple enlargement.

Abscess of the prostate likewise usually follows acute inflammation, but may be traumatic in origin. Besides the history of the case, the course of this affection is so acute compared to that of enlargement of the prostate, that confusion is not likely to arise. Moreover, the abscess may point in the urethra, the rectum, or the perineum; and palpation may enable a diagnosis to be made before rupture renders it certain.

There is another affection of the region of the prostate, described as **sclerosis of the neck of the bladder,** and which has been especially studied by Chetwood [44]. Its symptomatology and morbid anatomy do not appear to differ materially from those accompanying post-inflammatory **atrophy of the prostate** as described by French writers. The symptoms of this affection and of those of senile enlargement of the prostate are almost precisely alike; but by means of the combined examination the absence of any enlargement of the prostate is readily determined.

Malignant disease of the prostate is chiefly of the adenocarcinomatous character. Sarcoma is very rare. *Carcinoma* of the prostate is distinguished by the great local and referred pain, which latter shoots down the inner sides of the thighs, and may simulate that due to stone in the bladder by being felt at the end of the penis. The prostate is found to be densely hard, enlarged, and firmly fixed; the rectal mucous membrane becomes adherent, and infiltration of the surrounding tissues finally becomes manifest. Hæmorrhage into the bladder or urethra may occur spontaneously. This is rarely the case in benign enlargement. In this connection it should not be forgotten that malignant changes in formerly benign overgrowths are not at all unheard of, and if we may believe the researches of Albarran and Hallé [3], may even be expected in more than one-tenth of all patients.

Sarcoma, when found in the prostate, may be distinguished

by the tendency which it possesses in common with other malignant tumors towards production of cachexia; this cachexia is developed more rapidly than is the case with carcinoma, and the rate of growth of sarcomata is, as a rule, more rapid.

Prognosis.

A question of considerable importance and much interest in connection with enlargement of the prostate is that of prognosis. In few other diseases is it so necessary for the surgeon to know what may be accomplished by the various methods of treatment possible, and in probably no other class of cases is he more severely blamed for errors in judgement. It is not sufficient, indeed it is neither ethical nor humane, to hope that the patient will die of some intercurrent affection before any necessity arises for instituting active treatment on behalf of his enlarged prostate; and hence every physician or surgeon who has such cases under his charge must give careful thought and attention to each individual patient, and must know whether the expectation of life will be lengthened or decreased by the treatment he proposes undertaking, or whether the certainty of a life of considerable discomfort for a rather prolonged period is not less to the patient's ultimate advantage than the immediate risk to life incurred by a somewhat severe and shocking operation, which, if successful, will enable the patient to live out his natural term of life in ease and comfort.

There are, then, two main questions to be solved in this connection: first, whether the patient's life can be saved, prolonged, or at least not sacrificed by the treatment to be pursued—that is to say, the question of mortality; and, second, whether the patient's sufferings will be relieved wholly or in part, or whether no change at all can be obtained—that is, the question of final functional results.

Under medical treatment and catheterism there is practically no possibility of directly terminating the patient's life; with

the understanding that every antiseptic precaution be taken in catheterization, his life may even be prolonged, and in certain cases made very comfortable. Many a patient who has to pass a catheter only once or twice in the twenty-four hours will live a life of perfect ease, and will round out his days without interruption. But where the catheter has to be passed frequently —that is to say, as often as four to six times in the twenty-four hours—or where its passage at even longer intervals is attended with pain or difficulty, catheterism must be considered at the present day an insufficient remedy, except in those who are already on the threshold of the grave. The expectation of life, moreover, in patients treated by catheterization, has been shown by Harrison [114] and by Lydston [148] to be, in the average, no more than four or five years; so that it is clear that the life of the average patient is shortened by such treatment.

The next mildest form of treatment is drainage of the bladder. By this means may be obtained relief of the cystitis, and consequently of the tenesmus, pain, and general unrest, in a certain number of cases. In my opinion, it is applicable chiefly to those in a very debilitated condition, or to the very old. Drainage by a permanent catheter introduced through the urethra can seldom long be endured, and is usually only to be employed in preparing the bladder for a radical operation. The successes of Thompson [225], McGuire [155], and others in treating these patients many years ago by means of suprapubic permanent drainage, and of Harrison [111] by means of a perineal tube, should not be forgotten at the present day; and while we recognize the inadequacy of such methods to restore the patient to his normal condition, yet in a limited number of cases they are still useful. Especially is this so in patients with very bad cystitis, and where some immediate relief is imperative. In such cases so radical an operation as prostatectomy will almost surely kill, unless time can be obtained to relieve the cystitis, to get the kidneys into fair condition, and to improve the general health of

the patient. In patients such as these, the formation of a permanent suprapubic fistula by McGuire's method, or, if the prostate be not too large, simple perineal prostatotomy with the introduction of a tube, will afford almost certain relief to the urgent symptoms, and in many instances will enable the constitution to withstand prostatectomy at a later date. Neither castration, vasectomy, nor ligation of the internal iliacs will act sufficiently quickly in such cases; indeed, in my opinion, these operations are no longer to be considered desirable under any circumstances.

The mortality attendant upon the various operative procedures will be discussed in greater detail in a future chapter; it is sufficient here to consider their relative danger.

In the first place, it is quite evident that of those deaths, and they are few in number, that do follow the institution of drainage by suprapubic cystotomy or perineal prostatotomy, only a very small proportion, if, indeed, any at all, can be blamed upon the operation itself. Practically every patient who submits to such an operation is already in an extremely critical condition, and without such intervention would die at least as soon as, probably sooner than, if he had not been operated upon.

The Bottini operation stands midway between the palliative and the radical methods of treatment; and while its mortality is slightly less than that of prostatectomy by either the suprapubic or the perineal route, yet its results are so extremely uncertain, both as to immediate relief of symptoms and as to permanency, that it is not, in my opinion, an operation to be advised except in a very limited group of cases.

The radical operations have a distinct mortality *per se*, even when all mitigating circumstances have been considered, and all doubtful cases have been excluded. A few patients die from the operation itself, and we cannot escape the conviction that in such cases they would not have died at that time if no operation had been performed. Hence the conscientious surgeon will make

it a matter of the utmost importance to so select his cases that he will not be forced to say to himself, "Had my treatment been different, my patient would have recovered, or at any rate he would not have died as a result of my treatment."

The proper treatment, therefore, of prostatics—a convenient term adapted by Belfield [18] from the German *Prostatiker* and the French *prostatique*—resolves itself into a choice of remedies, not into any hard and fast rules which may not be transgressed. It has been well said that he is either a fool, or at best a surgeon of very limited experience, who knows of only one method of treatment for a certain class of cases; and while I myself may maintain that a certain treatment is the best, I do so with the distinct reservation that it is not immediately applicable to every case.

TREATMENT: CONSTITUTIONAL; CATHETERISM; PREVEN-TION OF COMPLICATIONS; AND TREATMENT OF COMPLICATIONS.

Patients afflicted with enlargement of the prostate should to preserve their health make everything in their life subservient to regularity and temperance. By regularity I mean the avoidance of everything which is not habitual; there should be no exceptions to the amount of sleep, to the hours of meals, to the daily constitutional walk, to the hour of retirement, to the distance travelled, to the quantity of food and drink, to the amount of intellectual labour, or to anything which arises in a man's life. And temperance is epexegetical of regularity: not only should everything conjoin to allow the patient to pursue the even tenor of his way, but there should be moderation in all things; his habits should embrace the happy medium in which alone the path of safety lies.

Such habits as these are possible only for the man who is in easy circumstances. The day-labourer, the overworked artisan, who knows not in the evening whence will come the money to buy the morrow's bread, cannot, if he would, lead a life of such orderly quiet as is enjoined on his more fortunate neighbour. And it is only where this life can be led that the purely palliative treatment can be expected to render the patient comfortable. Where it cannot be pursued, radical treatment is urgently demanded to restore the individual to his former condition of independence.

1. Constitutional Treatment.

(a) **Hygienic Treatment.**—Regularity and temperance being our watchwords, they are to be applied to every aspect of the

individual's life.   If possible, suitable climatic conditions should
be obtained, the cold winters of the north being avoided by so-
journs in lower latitudes.   The patient's clothing should be
warm enough to avoid chilling at all seasons of the year.   Flannel
in cold weather, and silk in hot weather, should be worn next
the skin.   Especially important is the avoidance of wet feet.
Waterproof shoes should be worn, or sandals of rubber should
be constantly carried in the overcoat pocket, ready for use in
any emergency.   Of more value even than these precautions,
oftentimes, is the invariable rule to change the shoes and stock-
ings immediately upon the return from being caught in any
dampness, no matter how trivial it may appear.   Even if the
feet do not feel wet, it is a safe precaution to change the shoes
and stockings as a matter of habit.   A very slight ischæmia of
the cutaneous circulation may bring on alarming prostatic, vesical,
and renal congestion, with retention of urine and even uræmic
symptoms in a very short space of time; and of no conditions
than these is it more true that an ounce of prevention is worth
pounds of cure.   It is less dangerous to become overheated than
to be chilled, provided chilling is not the consequence of becom-
ing overheated.   To perspire freely is good for these patients;
and for the purpose of aiding the excretory action of the skin
regular bathing should be enjoined, provided it can be done in
a well heated and ventilated bath-room.   It will be found safer
with patients of advanced age to depend on moderate sweating,
followed by a carefully administered sponge bath, or even on
merely rubbing the skin dry, where an attendant cannot be pro-
vided for bathing, than to risk exposure in a poorly appointed
bath-room.   The water should be warm; if kidney disease is
present hot baths are a valuable adjuvant in securing proper
excretion of the waste products.   Cold baths are to be condemned.

Hot sitz baths immediately before retiring are very grateful
in some cases.

The bowels should be regularly opened at least once each day;

and even if they act normally, the use of a brisk saline cathartic is to be enjoined at least once a month. Straining in defæcation causes general pelvic congestion, and this reacts unfavourably on the prostate.

The urine is never to be retained beyond the accustomed period of three or four hours during the day. Holding it longer will be very apt to render the patient unable to evacuate it when he finally makes the attempt. The bladder is to be scrupulously evacuated as the last thing just before getting into bed. If the patient is forced to urinate during the night, it is better for him to use a urinal without leaving his bed, and thus avoid exposure and unnecessary exertion. Of course, where the patient is unable to make his water in the supine position, he will usually have to leave his bed entirely for this purpose. Socin and Burckhardt [212] condemn the practice of urinating in the supine position, stating that the extra straining thus necessitated predisposes to atony of the bladder. The patient may try, at all times of the day, urinating in the knee-chest position, so as, if possible, to overcome the retroprostatic pouch by the aid of gravity.

The patient should, on the other hand, be discouraged from passing his urine unnecessarily often. With a bladder not markedly diseased it should seldom be imperative to evacuate less than six or eight ounces of urine at a time.

Six to eight hours is enough for a patient to spend in bed at night. If more sleep is required, a nap may be taken in the daytime. He should not sleep long in the same position, changing after an hour or so from the back to one side, and again to the other, so as to avoid congestion of the vesical neck and prostate. Where exercise cannot be taken, massage is an invaluable substitute.

His daily occupation should be such as does not require exertion either constantly in mild degree or occasionally to excess. It should not interfere with his meal hours, nor by causing mental

worry or fatigue interfere with his repose at night. He should "go softly all his days."

(b) **Dietetic Treatment.**—Certain articles of diet are notoriously unwholesome even for the healthy man, but in addition to eschewing these, the prostatic should likewise avoid certain edibles usually regarded as harmless. Vegetables of all kinds are permissible, and meats in moderation. The frequent association of kidney disease makes poultry a more suitable animal food than butcher's meat. Of this latter food, especially to be avoided are pork, ham, sausage, veal, and to a less degree beef. Stewed sweetbreads, boiled fish, stewed or raw oysters, are wholesome articles, and may largely replace meat. Clams and crabs are very unsuitable. Eggs and cheese are to be partaken of with caution.

Potatoes should be taken sparingly; green vegetables, provided they do not upset the stomach, are to be allowed liberally, as they tend to keep the bowels soluble. Spinach, cauliflower, asparagus, stewed celery, squash (marrow vegetable), and similar vegetables are the best. Tomatoes, peas, and beans are to be allowed only occasionally, and in great moderation. Corn is not to be taken at all. For solid eating none is so suitable as well-boiled rice. Cereals of all kinds may be given, especially barley; also wheaten and rye bread, but never hot, nor in any amount when fresh.

Salads and highly seasoned gravies and sauces are to be avoided, although lettuce or even fresh celery, with French dressing, may be occasionally indulged in.

Of fruits, the most suitable are prunes, especially when stewed without much sugar; stewed rhubarb is another suitable dish; grapes, particularly those of California; oranges, lemons, pears, and apples, in moderate quantities may serve occasionally to vary the monotony. Figs, bananas, peaches, blackberries, strawberries and raspberries are harmful in the order named.

Almost any kind of milk dessert is permissible, including tapioca, sago, rice and bread puddings, as well as ice-cream.

Great abundance of fluid should be taken, except, of course, where, from renal complications, polyuria is the most distressing symptom. Water is, of course, the most valuable beverage, and the most constantly palatable; and is probably of quite as much value uncarbonated and in its natural state. But the various alkaline waters may do good where the urine is acid and the diathesis gouty. The drinking of milk is to be especially encouraged. Alcoholic beverages are best avoided altogether; but here, as elsewhere, I think that long-continued habits should not be rudely disturbed, and prefer to allow my elderly patients to continue in the very moderate use of whiskey with their meals, as in such quantities, and for such patients, it acts as an undeniable aid to digestion. Whiskey is probably, when good, the least harmful form in which these patients can take alcohol; the light Rhine wines also, Hock, Moselle, and others, may be taken, but Port and Madeira are to be studiously avoided. Claret may be allowed in moderation. An excess of sugar throws hard work on the kidneys and bladder, and predisposes to urinary fermentation. Tea is better than coffee, and coffee than chocolate; but none of these beverages should be taken more than once a day, and then in the morning, and with a liberal dilution of milk or cream.

Food should not be partaken of late at night; if possible, dinner should be the midday meal. No fluid should be taken during the evening nor on retiring for the night. Patients often find themselves able to sleep the night through without urinating if this rule is observed. Yet in some gouty patients where the urine is much concentrated, a glass of water drunk just at bedtime will, as remarked by Moullin [176], by diluting the urine and rendering it less irritating, have the same effect.

(c) **Drugs.**—Very few drugs are of any permanent service in enlargement of the prostate. Tonics are usually indicated for the general health; and of these I would recommend the time-honoured combination of the tincture of nux vomica, with

dilute hydrochloric acid and some simple bitter, such as the compound infusion of gentian, as being as suitable as any other prescription. Strychnine itself does not seem always to have the same happy effect on the stomach that the tincture of nux has, and unless the heart demands training I usually prefer the tincture.

As already mentioned, an occasional cathartic is useful in every case; but many patients are habitually constipated, and must, even in addition to a diet carefully selected for this purpose, take a laxative almost constantly. For this purpose I am in the habit of employing either pills of aloin, belladonna and strychnine, or, which is preferable if the patient will take it, the fluid extract of cascara sagrada (Rhamnus Purshiana, U. S. P.). These remedies should be commenced in active doses, and the amount taken reduced, as soon as may be, to the least possible required to produce the desired effect. Some patients will keep their bowels happily regulated by chewing senna leaves or rhubarb root, of which they become almost fond in time. Compound licorice powder is another favourite remedy with some. Enemata of cold water may be useful in stimulating the lower bowel, and in decreasing the pelvic congestion. Iodoform or glycerine suppositories may be employed in preference to injections; or ichthyol, locally, or by mouth ten drops in a capsule three times daily. The patient will usually learn what form of medication suits him best, and will after experiencing a few times the discomforts of constipation and hæmorrhoids, be very eager to avoid their recurrence, by properly regulating his diet and medicines.

The tone of the bladder is best maintained by preventing overdistention. Atropine should never be given long at a time; hence the preference expressed above for cascara sagrada over the use of A. B. & S. pills. Strychnine in one form or another is about the only drug which seems to have any influence on the contractility of the bladder; and as in the form of the tincture of nux vomica it acts favourably on the stomach, the intestines,

the bladder, and also the heart, is probably the most useful single drug we have. Its prolonged use, however, is injurious, patients becoming nervous and fidgety when it is persisted in. The dose should not, as a tonic, exceed one-fortieth of a grain three times a day; usually one-sixtieth is sufficient, except, of course, where stimulation is required.

For the heart, besides strychnine, as recommended above, an occasional course of digitalis will be found beneficial. This drug also increases the amount of urine excreted by increasing the forward pressure in the kidneys, and to flush these organs out it is at times an invaluable remedy. It should never be continued long, both on account of its cumulative action and the danger which always exists of exciting an intractable gastritis. The kidneys are best controlled by diet, no drug being of any lasting benefit.

For the prostate itself there is no specific. I am, however, a firm believer in the occasional value of ergot. During an accession of prostatic and vesical congestion, often accompanied by a fit of the piles, and with retention of urine, there are few prescriptions which afford the patient such comfort after the urine has been evacuated by catheter, as the following:

> ℞. Ext. Rhamni Purshian. Fl. ....f℥ss
> Ext. Ergotæ Fl. ....f℥j
> Ext. Hamamelis Fl. ....f℥iss.
> M. S.—Teaspoonful three or four times daily, in water.

For the urine there are many drugs. It is readily diluted by increasing the amount of fluid, especially water and milk, ingested; and may be concentrated by withholding fluid and promoting perspiration. Boric or benzoic acid will be found useful for alkaline urines, and may be given separately or combined, about five grains of benzoic acid being prescribed with double the quantity of sodium borate, to ensure solution. Salol is an excellent urinary antiseptic, and with boric acid, may be employed for considerable periods—several weeks at a time—

without producing injurious effects.   Sodium benzoate is another good drug; urotropin, however, I prefer.   With piperazine I have little experience, and seldom employ it or the more irritating drugs, such as uva ursi, cubebs, buchu, and copaiba.   For excessively acid urine the best remedies are a change in diet, especially a reduction in the amount of sugar, and dilution by an increase in the ingested fluid.   The neutral or alkaline salts of potassium and sodium will usually be found to aid the change in reaction.   The officinal solution of potassium citrate may be freely taken; and the alkaline mineral waters and purges may be advised.

2. Catheterism.

It is my opinion that every patient should have a trial of catheter life, or catheterism, as it is called.   I am well aware that many patients commence to fail as soon as this course of treatment is entered upon, and such should certainly be cared for by other means; but it is usually impossible to say who will and who will not be benefitted by regular catheterization, and the only sure way to determine this question is to try and see.

Catheterism will cure no patients.   Some individuals may have their symptoms relieved, and be able to dispense with the catheter in the course of a few weeks; but such cases are probably those where the onset of the symptoms was due largely, if not entirely, to congestion of the prostate and its surrounding structures, and not to permanent obstruction from enlargement.

But before entering upon the subject of catheterism in detail it will be convenient to discuss first the different varieties of catheters to be employed, and then their sterilization and preservation.

(a) **Catheters.**—Catheters are divided by systematic writers into the flexible, the semi-flexible, and the inflexible, of which three types, the Nélaton or soft-rubber catheter, the English

PLATE LX.

GEMRIG
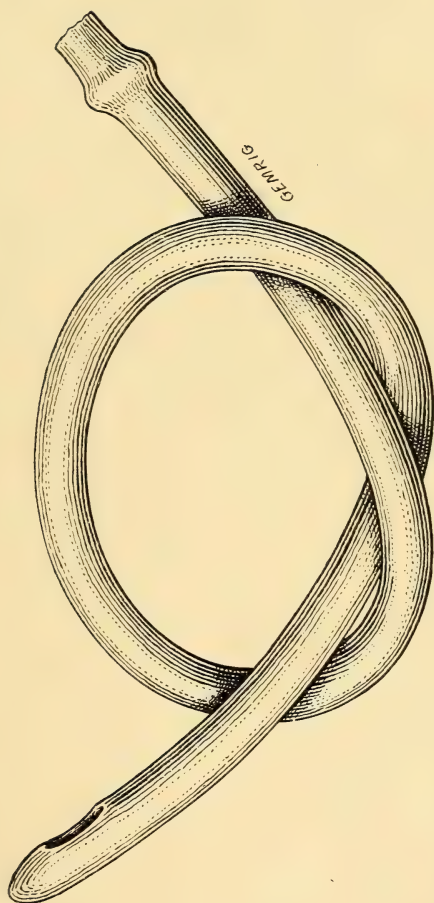
SOFT-RUBBER CATHETER (NELATON). NATURAL SIZE OF NO. 21 OF THE FRENCH SCALE.

or webbed catheter, and the metallic catheter, are good represen-
tatives.

The soft-rubber catheter, known by Nélaton's name, should
for the purposes of prostatic surgery be fourteen or sixteen inches
long at the least. Its tip should be solid beyond the eye, and
the eye should be moulded in the manufacture of the instrument,
and not cut afterwards. By having the tip solid there is no
space for the collection of filth, to act as a ready culture-medium
for germs, and by having the eye moulded, not cut, there is the
assurance that its edges will be smooth and well turned, so that
by no possibility can the urethra be damaged. The catheter
employed should be new; and as soon as one commences to grow
old it should be discarded. There is great danger of old rubber
breaking and of leaving a portion of the catheter in the urethra
or bladder, if it becomes brittle; and when it has become flimsy
and collapsed it is exceedingly difficult to introduce.

The English catheter is made of webbing, covered with shel-
lac, which renders its surface smooth, and gives a certain degree
of rigidity to the instrument. These catheters are provided with
stylets. Cheap English catheters are not worth buying: they
are thin walled, break easily, or at least become creased, even
when in the urethra, and are sometimes perforated by the stylet
when in use. The tip of an English catheter is hollow like the
rest of the shaft, and contains the end of the stylet. If the tip
were solid, there would be constant danger of the stylet protrud-
ing at the eye, and thus lacerating the urethra. These catheters
are of such consistency that when placed in hot or even moderately
warm water they become limp, and can be readily moulded to
any desired curve; and by the action of cold water they again
become quite rigid, and will retain their form long enough for
use. When not in use, they are kept on the stylet, which should
be of the curve desired. As a rule, they are used without the
stylet, but this may be allowed to remain in place if more firm-
ness be required. When the curve requires to be altered during

10 P

use, this is readily accomplished by partially withdrawing the stylet, as will be more fully described on a subsequent page.

The elbowed (*coudé*) catheter of Mercier is a very valuable instrument made of much the same material as the English catheter. Unlike the English catheter, however, the instrument of Mercier should have its tip solid; the beak is about three-quarters of an inch in length, and is set at an angle of 110 degrees with the shaft, which is straight, the eye being in the flexure between the two; or there may be one eye on each side of the beak. It is important to purchase only catheters of this variety where the angle is produced in the process of weaving, and to avoid those catheters, of which there are many in the shops, which have been woven straight, and which have had the end subsequently turned up. This latter variety is cheaper, but the elbow seldom is sufficiently pronounced when new, and very soon disappears altogether by the catheter resuming its original linear form. The catheter employed by Leroy d'Étiolles had a longer elbow, which was set at an angle of 130 degrees with the shaft.

The double-elbowed (*bi-coudé*) catheter is, as its name implies, one where the terminal portion has a second angle about one inch and a half back of the first. It is made of the same material as that with the single elbow, but the second angle is not so abrupt as the first. Where the tip of the single-elbowed catheter is hollow it may be passed with a stylet of similar form, when by partially withdrawing the stylet a second elbow will be produced at any desired situation (Guyon). There is little risk of the stylet protruding at the eye in its passage, as will be seen by practising these manœuvres before introducing the catheter.

All catheters made of webbing should have the eye woven in the making; to have it cut subsequently leaves a sharp and often-times ragged or ravelling edge.

It is convenient in these, as well as in curved metallic ure-thral instruments, to have some indicator on the handle to show which way the beak is pointing. So far as I know, there is at

PLATE LXI.
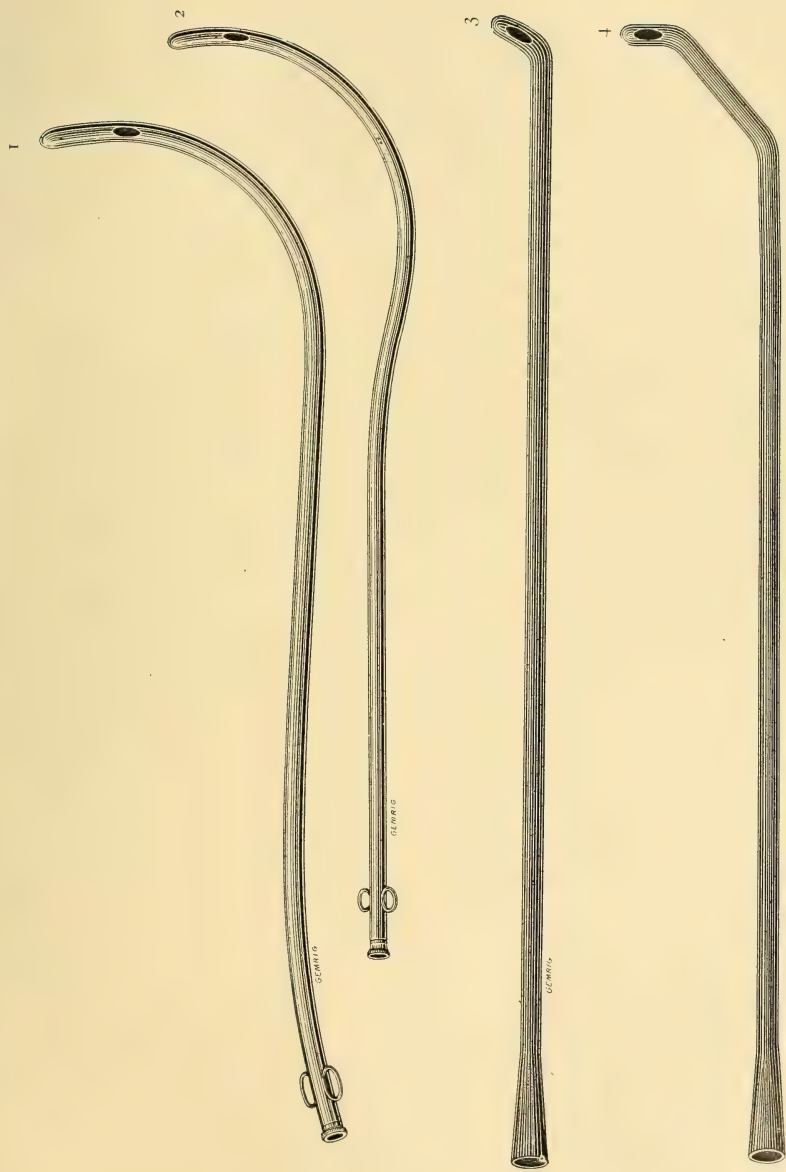
1, 2. Metallic catheters with prostatic curves. 3. Mercier's elbowed, or *condé* catheter. 4. Double elbowed, or *bi-condé* catheter. (Half natural size.)

PLATE LXII.
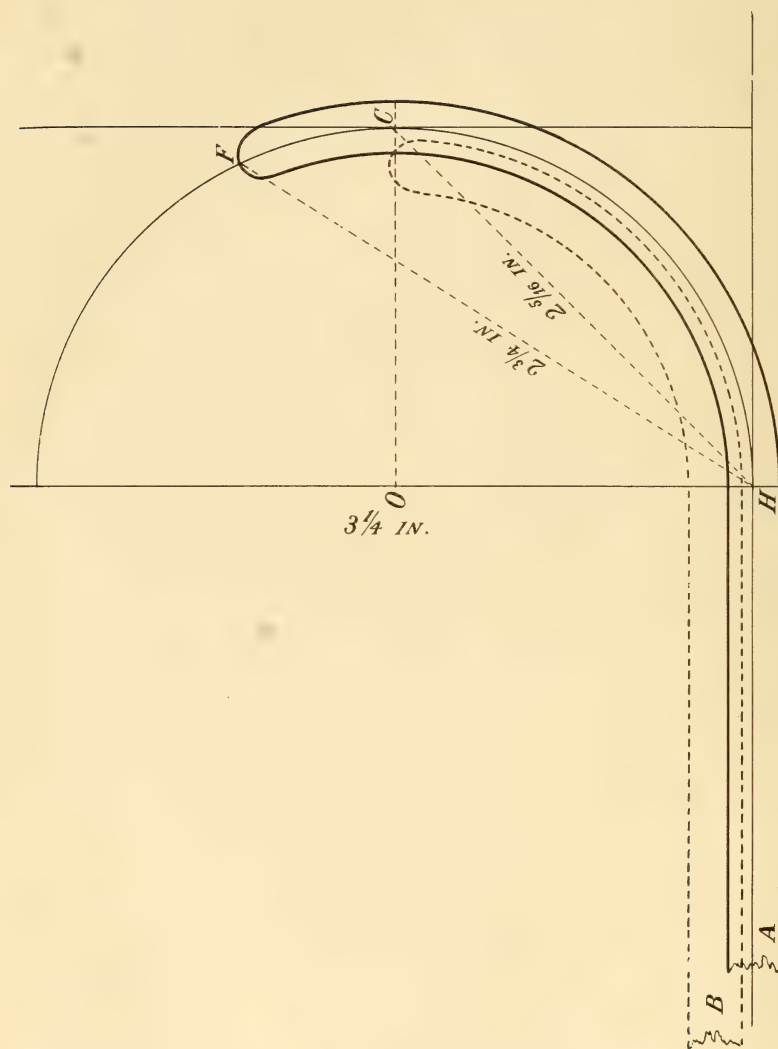
DIAGRAM OF THE PROPER CURVES FOR THE ORDINARY AND THE PROSTATIC CATHETER.

O H. Radius of circle whose diameter is 3¼ inches. H C. Curve of ordinary catheter, subtended by a chord of 2 5/16 inches. H C F. Curve of prostatic catheter subtended by a chord of 2¾ inches.—(*After Van Buren and Keyes*). (Larger than natural size.)

present no better way provided of determining this point in the case of the Mercier catheter than by recollecting the relation to the beak borne by the printing on the shaft. With the English catheter a similar precaution may be employed, except when it is used with the stylet, when the ring-like extremity of this guide will indicate the direction of the curve.

Metallic catheters have usually a curved beak. The original Mercier catheter was silver, but, as already mentioned, it is usually now made of webbing. The normal curve of the subpubic urethra is that of the circumference of a circle whose diameter is three and one half inches; and the length of curve is the arc subtended by a chord of two and three-fourths inches; but the curve of the catheter is usually subtended by a chord of only two and five-sixteenths inches. (Van Buren and Keyes.)

In the urethra altered by prostatic enlargement, however, the curve is considerably increased, having both a greater diameter and a greater length of arc; so that various metallic catheters with "prostatic curves" are found on the market. Probably the largest required curve is one which is one-third of a circle whose diameter is five and a half inches. It is important not only to have the curve thus larger, but for the curve to be greater at the tip than elsewhere, thus approaching the instrument of Mercier in type. At the very least, the curve should be continued to the very end of the catheter.

The tip of metallic catheters should be solid, to allow no nidus of infection to exist, and it is even more indispensable here than in the case of the webbed catheters for the eye to be made in the mould, and not to be subsequently cut out by a punch. The shaft should be at least nine inches in length beyond the beginning of the curved beak, since with an instrument of customary length the bladder might not be reached.

Metallic catheters should be plated with nickel, silver, or some other non-corrodible metal; and should be provided with two eyelets at the handle, to serve as indicators of the direction

in which the beak is pointing.   Or the catheter may be S-shaped, the opposite direction of the two curves effectually indicating the position of the beak.

In all these catheters for use in prostatics the eye should be amply large, and should be placed in the concavity of the curve; or one eye may be placed on each side, at different levels, but between a half an inch and an inch from the end.   It is also best to use an instrument of as large a calibre as the urethra will conveniently take, since there is thus less danger of entering or of producing false passages, and a better chance exists of evacuating pus or blood clots from the bladder.

(b) **Sterilization of Catheters.**—Soft-rubber catheters may be boiled.   If they are stewed, the elasticity and tone is lost very soon; but if the water is brought to the boiling-point before the catheter is placed in it, the rubber will stand repeated boilings of from three to five minutes without showing material degeneration.   Where boiling cannot be employed, as is the case under some circumstances with rubber catheters, and with all catheters made of webbing and coated with shellac, chemical disinfection must be used.*   Carbolic acid, in the strength of one part to twenty of water, has been much relied upon, the catheters soaking in such a solution for twenty or thirty minutes.   This substance has the disadvantage, however, of rendering the catheters so flimsy, even when the solution is cold, as to make them very difficult to use; so that latterly I prefer a ten per cent. solution of formalin, which is itself a forty per cent. solution of formaldehyde gas in water.   The well-known hardening effect of formalin preserves the desired form of these catheters admirably.   Some surgeons have found the use of formalin so irritating to the mucous membrane of the urethra as to cause great pain to the patient,

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* Mr. Moullin [176], however, states that Messrs. Maw, Son and Thompson make for him aseptic catheters, semi-flexible, which "will stand boiling for five minutes every day for months together (provided they are kept straight while in the boiling water and are drained well afterwards)."

PLATE LXIII.

English catheters — in her
the handle the
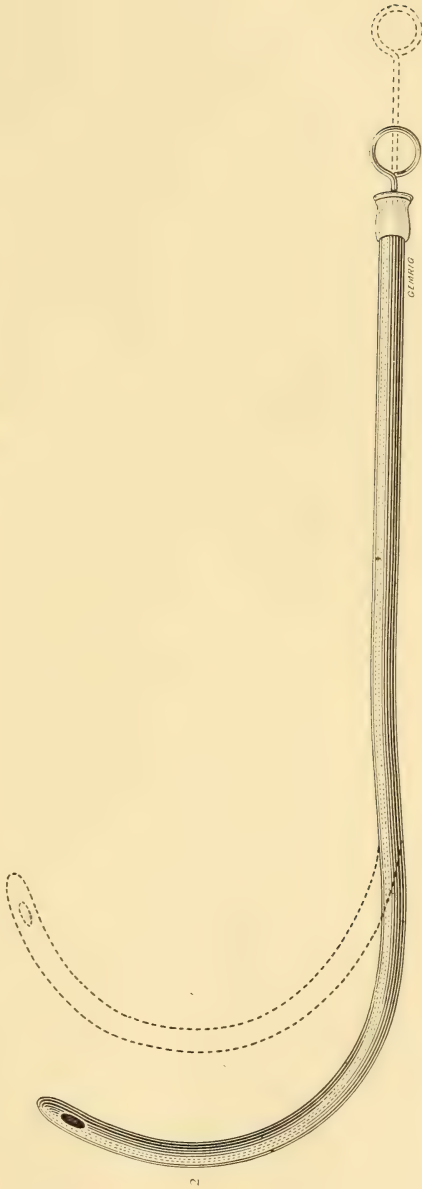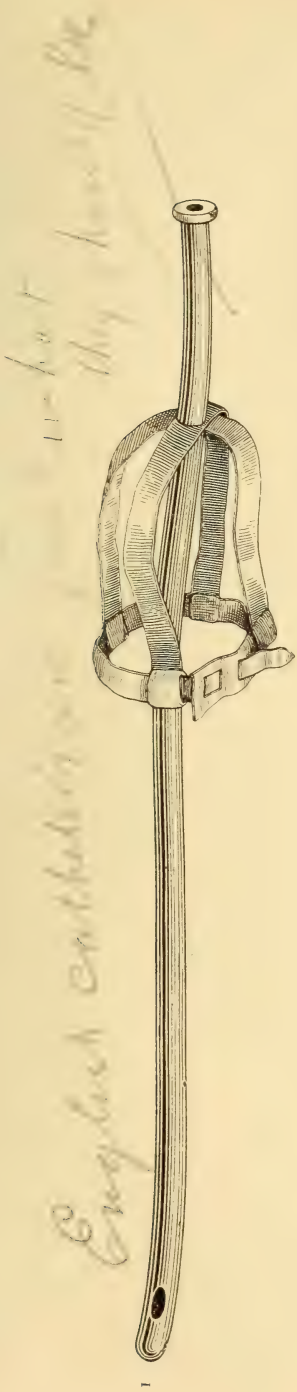
1. Catheter with bridle attached, to facilitate its retention in the bladder. 2. English catheter on overcurved stylet. The dotted lines show the curve increased by partially withdrawing the stylet.

as well as at times to produce a rather severe urethritis. I have not myself, however, seen any such effects. Wolff [256] advises the use of a one per cent. solution of corrosive sublimate in equal parts of glycerine and water, the catheters being germ-free at the end of six hours. This solution is claimed to possess the threefold merit of sterilizing the catheters, preserving their elasticity, and rendering them ready for instant use without the intervention of any other lubricant.

Metallic catheters are readily sterilized by boiling. The practice of merely igniting alcohol which adheres to their surface is by no means sure as a disinfectant, unless the catheter is already of more than ordinary cleanliness. Where catheters are religiously cleaned and boiled after each time they are used, this method will serve very well as a rapid and efficient manner of sterilization; but if the catheter has been put away with septic blood clots or inspissated pus in its interior, it is idle to expect the momentary application of a flame to its surface to render infection impossible.

All catheters should be subjected to the ordinary rules of surgical cleanliness immediately after being used. After being washed clean in soap and hot water, and their cavities thoroughly syringed out, and emptied if need be of clots, etc., by means of absorbent cotton mounted on a stylet, they should be returned to the antiseptic solution; or if there will be no need for their use soon again, they may be wrapped in a sterile towel, after being shaken dry in the air.

Rubber preserves its elasticity better when kept wet, and it should never be laid away in a dry warm place.

A powder known as trioxymethylene, which slowly gives off gaseous formol, has been much used abroad for the purposes of sterilizing webbed and rubber catheters. It is placed in the hollow of a specially constructed stopper, and its vapour passes through perforations in the lower surface of this stopper into the interior of the glass case in which the catheters are contained.

Where this powder cannot be obtained, a piece of absorbent cotton moistened with formalin may be placed in the catheter case.

Where the patient has to catheterize himself, and must care for his catheters in person, it is expedient to render his necessary manipulations as simple as possible. Moullin [176] recommends that he keep in his wardrobe, or wherever else may be most convenient, two glass cases, long enough to contain the catheters without bending them; one case should hold a small piece of absorbent cotton moistened with formalin, and the other should be filled with boric acid solution, which should be changed every day. A douche bag filled with a strong solution of green soap should also be provided. The catheters, which should at least equal in number the number of times during twenty-four hours that the patient must catheterize himself, and which are of course flexible or semiflexible, should be rinsed through thoroughly with the soap solution and hot water immediately after use, and then be placed in the boric acid solution. Once each day, or oftener, all the catheters should be boiled, and then stored in the formalin case until ready for use. It appears to me that this is rather a complicated process of sterilization for the average prostatic; and I would at any rate suggest that after use and cleansing with the soap and water, the catheter should be placed in the formalin jar, and remain there for six hours at the least. It may then be transferred to the boric acid solution for some time before use, and thus will have been sterilized by the formalin, and will have had the irritating qualities of this antiseptic removed, before being brought into contact with the urethra. By this plan also the necessity of boiling is avoided, and however useful this may be for metallic and india-rubber instruments, I cannot but think it destructive to those constructed of webbing and covered with shellac.

English catheters should be kept mounted on a stylet of proper curve, and be immersed in the antiseptic solution (for-

PLATE LXIV.
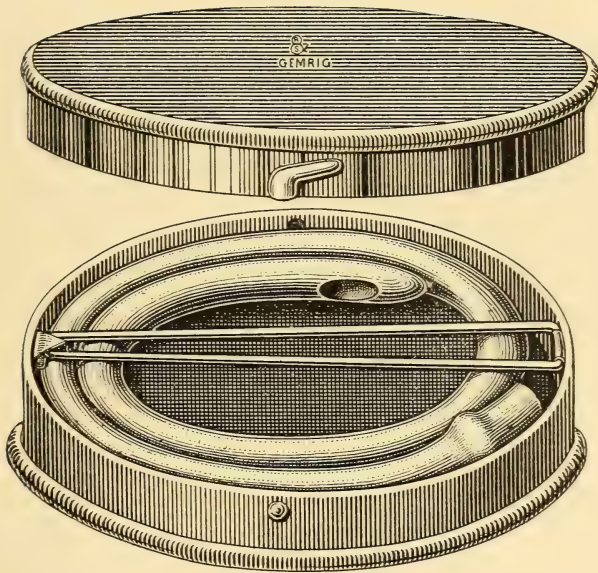
ASEPTIC POCKET-CASE FOR CATHETER. NATURAL SIZE.

malin or carbolic acid) for a half-hour before they are used; they should then be thoroughly cleansed and dried. Freyer [89] is quite content if he can accustom his patients to the conscientious use of soap and hot water. The hands, foreskin, glans penis, and the urethra of the patient should be suitably prepared for catheterization as directed at page 136.

When the patient travels, he must be able to carry his catheter with him in an aseptic and yet not too bulky a form. For this purpose various pocket cases are found in the shops, of which the best are made of metal, so that some formalinized cotton can be kept in them along with the catheter, which is coiled up so as to occupy less space. An ordinary metallic soap-box may be used.

(c) **Lubricant.**—For many years olive or castor oil has been employed as a lubricant for catheters. These substances may be sterilized by boiling, but unfortunately they do not remain sterile very long; and the addition of strong antiseptics is very apt to roughen the surface of webbed instruments in time, or else is ineffectual in sterilizing the oil. Yet I am myself quite satisfied to use carbolized olive oil of the strength of one to twenty. Senn [210] recommends "sterilized vaseline, with the addition of $2\frac{1}{2}$ per cent. carbolic acid or 1 per cent. of formic aldehyd." Burckhardt [212] prefers a one per cent. solution of salicylic acid in sterilized olive oil; while, as already mentioned, Wolff [256] lubricates and at the same time sterilizes his catheters in a one per cent. sublimated solution of glycerine and water. An aqueous solution of boroglycerine is another useful lubricant.

When the patient catheterizes himself, it is far safer as well as more convenient for him to be provided with numerous flasks each containing ten cubic centimetres of the lubricant, which he then squeezes directly into the urethra, thus minimizing the risk of infection.

(d) **Method of Passing Catheter.**—The choice of catheters should always be for the soft-rubber first, then for the Mercier,

then the English, and finally, in rare instances, the metallic instru-
ment.   There is probably no department of surgery in which
practice, habit, natural aptitude, a light hand, good temper, and
patience, are of such paramount importance as in catheterization.
It will seem to the patient as if one surgeon rushed at him from
the other end of the room with a crowbar in his hand, prepared
to plunge it into the unfortunate man's urethra, while another
surgeon will gain entrance to the bladder before the patient has
really become aware of his manœuvres.   And it is next to im-
possible to inculcate by precept the many tricks which may be
required to insinuate a rebellious catheter into an obstructed
urethra: only by example and long-continued practice may the
uninitiated learn these matters.

It is always good to have clean hands, and should be a char-
acteristic of the surgeon; but where a flexible catheter is to be
passed ordinary cleanliness will not suffice.   As it is necessary
always to hold such an instrument close to its point of entrance
into the urethra, and as therefore it must be fingered throughout
its whole length during its introduction, the surgeon's hands
should be sterilized as for a serious operation before he presumes
to touch the sterile catheter.

The glans penis and the foreskin of the patient should be
washed with soap and water, the fatty subtances then removed
with seventy per cent. alcohol, and finally the glans should be rinsed
with corrosive sublimate solution (1 to 1000); the anterior urethra
should next be flushed out, first, if possible, by directing the patient
to pass what urine he is able, and then by an injection of boric acid
solution (two per cent.).   The catheter then being taken in
hand, should be thoroughly lubricated by being dipped in a suffi-
cient quantity of the lubricant, which is then allowed to run up
its whole length; or an injection of the lubricating fluid may
be made directly into the urethra.   The end of the catheter is
then to be carefully inserted into the meatus.   I may say here
that where there is a prospect of oft-repeated and long-continued

PLATE LXV.
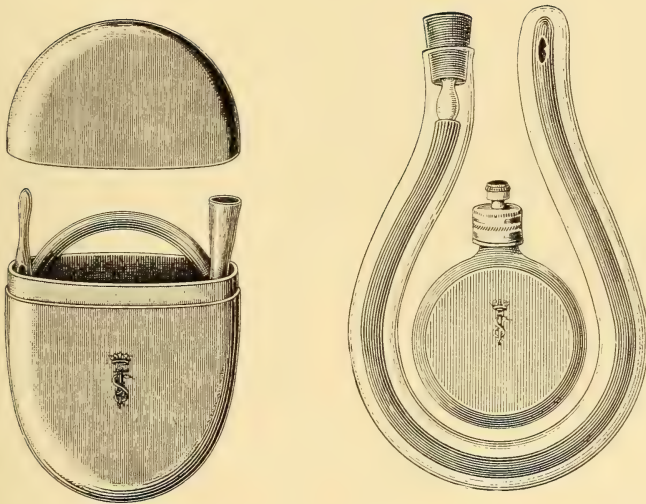
ASEPTIC CASES FOR CATHETERS.
The U-shaped tube has a special flask for the lubricating fluid.

use of the catheter, I think it wisest to do a meatotomy at once, when the meatus is not amply large.

The Nélaton catheter is so flexible that it must, as already mentioned, be held close to the penis, and urged forward an inch or less at a time. In fact, the urethra should seem rather to swallow the catheter than that the latter was being forced in. It is well to know just how long the catheter is, so that the amount already introduced may be readily gauged from the portion which still remains within the hands. If when the tip of the catheter has reached the prostatic urethra it will not readily pass onwards, the finger should trace its course through the perineum and from within the anus, and an attempt should be made to direct it on into the bladder. If the catheter feels firmly imbedded, it should be partly withdrawn, and then again passed forwards with a quicker and somewhat rotatory motion, as its tip may have been engaged in a false passage or entangled in a fold of mucous membrane. At the same time, with the finger in the rectum the catheter's point should be kept against the upper wall of the urethra, out of the usual neighbourhood of false passages and obstructions. If, finally, no reasonable endeavours will succeed in introducing the soft-rubber catheter into the bladder, this instrument should be withdrawn, and a Mercier elbowed catheter passed. The manner in which this catheter is to be handled does not differ materially from that just described; but it should be the surgeon's care that the elbowed beak follows the roof of the urethra, as it will thus be more likely to glide over the raised internal orifice of this canal.

The Mercier catheter failing as well, the surgeon should next attempt the English catheter, moulding it to a proper curve before introducing it into the urethra. If it will not pass without the stylet, it should be withdrawn, and then re-introduced with the stylet in its interior. When the obstruction previously encountered is again met, if slight persistence in pressing the handle well down between the patient's thighs will not cause

the beak of the catheter to surmount the obstruction, the surgeon
may by withdrawing the stylet about a half an inch raise the
beak a sufficient distance to enable it to ride over the prominence
of the prostate.   It is very rarely ever necessary to employ silver
catheters in recent cases—that is to say, in cases where the ure-
thra has not been much tampered with by other instruments.
Occasionally, however, where there has been long-standing in-
flammation of the parts about the prostate and the vesical neck,
the tissues are so hard and resistant that although no real mechan-
ical obstruction may exist to the passage of a catheter, yet the
flexible and semiflexible instruments are not strong enough to
press apart the sclerosed structures.   In cases such as this, the
use of a metallic catheter may be indispensable; but in employ-
ing one it should be constantly borne in mind that even the very
minute amount of force that is justifiable here will do an incal-
culable amount of damage unless the channel of the urethra is
strictly adhered to.   Hence the surgeon should make it a golden
rule to cling close to the roof of the urethra, and to never for an
instant use any degree of force, however small, out of the median
line.   He will be far more apt to succeed in the object he has
in view if he keeps cool and avoids metal instruments.

If the first examination of the patient have been conducted
in the manner advised in Chapter VII, much valuable informa-
tion will have been acquired as to the character of the urethra
and its obstructions, so that at a later date catheters can be passed
with a fair amount of intelligence and certainty.

The patient should use himself the catheter which is most
easily passed; but he should never be allowed a metallic instru-
ment.   The soft-rubber catheter is the most harmless, but so
great seems to me the danger of infection from the necessity of
handling it so extensively during its introduction—an objection
which applies also, though in less degree, to the Mercier catheter
—that I have a strong preference for the English catheter for the
patient's use.   These catheters are so firm as to be readily intro-

duced by holding their outer end only, as with the metallic catheter, and are at the same time sufficiently flexible to render them safe in not very skillful hands.   Under these circumstances they should, of course, be passed without the stylet.

The frequency with which a prostatic should be catheterized depends *entirely* upon the distress occasioned by the residual urine, *provided* always that the latter is not increasing in quantity. As a rule, however, it will be found that when a patient has as much as four ounces of residual urine he will be so regularly disturbed at night as to require the complete evacuation of his bladder by catheterization once in the twenty-four hours.   The most suitable time for this evacuation is just before retiring for the night.   It is the least inconvenient time possible for the careful attention to personal and instrumental preparation, and is also a time when the emptying of the bladder will be apt to give the longest relief for the ensuing night.

Many a patient, nevertheless, who has this amount or even more of residual urine will not be sufficiently inconvenienced by it to necessitate regular catheterization at all.   The surgeon should not, on the other hand, dismiss such a patient from his care, but should attentively watch him, and by passing a catheter every three or four months ascertain whether the residual urine is increasing.   It is in just such quiescent cases as these that the residual urine accumulates, increment by increment, until atony of the bladder is well advanced, and overflow from retention occurs; or absolute retention with its complete dependence on the catheter makes the remaining days of the patient one long drama of misery.

If the residual urine, therefore, is found in the course of weeks or months to be steadily increasing in quantity, the surgeon should not hesitate, even though no compelling symptoms exist, to resort at once to habitual catheterization, as the only preventative of vesical atony.

Under either of these circumstances, then—the presence of

symptoms, or the steady increase in residual urine without symptoms—the catheter should be used once in the twenty-four hours for four ounces or less of residual urine.   If six ounces are present, use it twice, night and morning; and add one more catheterization for each additional two ounces of urine up to six times daily.   When the required number of catheterizations exceeds this limit, some other form of treatment is urgently demanded, even though catheterism appears to maintain the patient's normal health.

3. Prevention of Complications.

The most serious complications which it is our duty to endeavour to prevent are cystitis, retention of urine in all its varieties, calculus, Bright's disease, and uræmia.

Cystitis.—The causes of cystitis in cases of enlargement of the prostate being almost exclusively infection from without through instrumentation, the paramount importance of aseptic habits in this particular is readily recognized.   All that was said as to the means of sterilizing urethral instruments, the manner of introducing them, and the state of the surgeon's hands and of the patient's urethra, glans penis, and foreskin, should be borne in mind; as far as possible all instrumentation should be avoided; and, moreover, the diet and drugs habitually advised should be such as to prevent vesical congestion or irritability.   The state of the urine should be closely watched, and over-acidity or alkalinity strenuously combated.   If strictures exist, the prevention of cystitis is even more important, as the bladder will have been in a state of less resistance for some time.   Hence the strictures should be systematically dilated, the benefits derived from this treatment when carefully conducted far outweighing the dangers of infection.   The passage of large-sized steel sounds through the prostatic urethra also will tend to prevent progressive obstruction from the diseased organ, in accordance with the teachings of Mr. Reginald Harrison [110]; and by thus

maintaining an open channel for the urine, may postpone if not entirely prevent the developement of cystitis.

Although the prevention of cystitis is so important a part of treatment, it is a sad fact that the treatment of fully developed cystitis constitutes the greatest part of the surgeon's labour in these cases; and this is perhaps so because an uninflamed bladder rarely gives rise to feelings of discomfort on the patient's part or of anxiety on the part of his attendant. But some patients are so subject to urinary fever, that although they may recover from an attack, yet, this complication being ever present in the minds of both surgeon and patient, extraordinary methods are necessary to avoid its recurrence. In these patients more than any others should instrumentation be as limited as possible, and when necessary the most "pedantic precautions" (Senn, [210]) against infection should be observed. Quinine or opium, or both, should be administered some hours before the catheter is used, and should be repeated at intervals of three or four hours afterwards until all danger of chills and other infective manifestations has passed. As it is probable that both urethral and urinary fevers are occasionally due to the septic condition of the urine itself, and not to any new infection carried in by the instrument, it is well also to give these patients a course of urinary antiseptics, such as salol, urotropin, sodium benzoate, etc. Since, moreover, these manifestations of infection are predisposed to by interstitial nephritis, every effort should be made from the beginning of treatment to get the kidneys into good working order and to keep them so.

Retention of Urine.—There are several varieties of retention of urine, which it will be convenient to define at the outset, that we may know the conditions indicated by each term. First there is (1) Acute Complete Retention: here the patient, who was before able to evacuate his urine wholly or in part, becomes unable to do so—all the urine is retained, and the condition is acute. Second there is (2) Chronic Complete Retention, where

the patient depends absolutely upon the catheter as a means of emptying his bladder, being unable, quite as much as in the first variety of retention, to expel a single drop of his own accord—all his urine is retained, but the condition is chronic. Third there is (3) Chronic Incomplete Rentention without Distention of the Bladder, where a certain portion of urine is constantly retained, but where the major portion is evacuated voluntarily—a chronic condition, where, without the bladder being overfilled, residual urine exists. Finally there is (4) Chronic Incomplete Retention with Distention of the Bladder, where so much of the urine is retained that the bladder has reached the limit of its capacity, and overflow from retention results.

Guyon [108] mentions still another variety of retention, which he terms acute incomplete retention, and says it is very rare. I have not observed such a condition myself, and as M. Guyon leaves its symptoms somewhat to the imagination, I am unable to describe it more fully than by giving its title.

Acute Retention.—

1. Acute Complete Retention.

Chronic Retention.—

2. Chronic Complete Retention.
3. Chronic Incomplete Retention without Distention. (Residual Urine.)
4. Chronic Incomplete Retention with Distention. (Retention with Overflow.)

The first variety may attack either a patient with no residual urine, or one in whom the urine has been partly retained for some time. In either case it is almost invariably due to a sudden increase of congestion in the prostatic urethra and the vesical neck. Hence for its prevention all those things should be avoided which have already (page 122) been mentioned as favouring this state of affairs. Exposure, chilling of the skin, wet feet; retaining the urine an undue time; eating or drinking too freely; lying too long abed—all these things should be studiously avoided.

The second variety, chronic complete retention, is almost invariably the result of absolute atony of the bladder. It arises probably most frequently as a consequence of the third variety, where the residual urine slowly accumulating ultimately overcomes entirely the power of the bladder to contract and expel any portion of its contents. In some instances it is due to mechanical obstruction from the growing prostate, which prevents, even if the tone of the bladder is preserved, any urine from being expelled. In exceptional cases retention of this kind succeeds immediately upon acute retention, the bladder being then so very much distended that it never regains its contractility. This complication is hence to be prevented by regularly evacuating the residual urine by catheterization, and at times by moulding the prostate as it grows, so as to keep an open water-way from the bladder; also by preventing acute retention.

The third variety, that where a varying amount of residual urine is present, is the nearly universal state of prostatics, and is practically unpreventable. In the early stages of enlargement, if no residual urine exists, absence of symptoms is usual, and instrumentation in an attempt to hinder the growth of the prostate by pressure will be more likely to cause cystitis or prostatitis than to prevent the developement of a post-prostatic pouch.

The fourth variety, retention with overflow, succeeds upon the third when a very small amount of contractile force is still preserved in the bladder, and when the urethra is not absolutely obstructed by the prostatic growth. It rarely occurs where cystitis is present; and is best prevented by regular aseptic catheterization during the earlier stages of the disease.

Atony of the Bladder.—Atony of the bladder, it is thus seen, is an even more dreaded attendant upon prostatic obstruction than retention of urine, of whatever variety; for where atony is extreme, it cannot be remedied even by restoration of the urethra and vesical neck to their normal condition. Even

though the whole obstructing prostate be removed successfully, and an easy entrance to the bladder be gained by catheters, yet the power of contractility lost from prolonged overdistention will in some cases never be regained. Fortunately, however, we no longer give so gloomy a prognosis as it was customary to do only a few years ago: we have learned through the brilliant successes of Mr. Freyer and other surgeons that in some instances where for fifteen or twenty years the patients had depended absolutely on the catheter for the evacuation of every drop of their urine—that in some cases such as these the complete removal of the enlarged prostate has within a few months or even weeks brought back contractility and good expulsive power to bladders that were thought before operation to be hopelessly diseased. And although, as I say, we can no longer regard atony which is apparently complete as entirely irremediable, we should nevertheless spare no pains to prevent its developement.   To this end the bladder should never be allowed to become distended.   Where the catheter is employed habitually, great pains should be taken to ensure its entrance into the bladder with the evacuation of all the residual urine, not merely drawing off the ounce or so that may exist in the dilated prostatic urethra, and leaving the true residual urine to accumulate until either complete chronic retention or retention with overflow has developed.   And where the catheter is not habitually employed, nothing should prevent regular periodical examinations to determine the question whether the residual urine is increasing or not.

Calculus.—The prevention of the formation of calculi in the bladder extends not alone to those means usually employed in patients where no prostatic enlargement exists; for in prostatics we have constantly present a stagnant pool of urine in the bladder, ready at any moment of neglect to crystallize around a blood clot or a plug of mucus or pus. The customary dietetic treatment must be employed; the urine should be carefully watched, and maintained in a dilute and unirritating condition; and the residual urine should be systematically evacuated.   In

patients with a family history of calculus, or with a lithæmic tendency, the rule of non-interference with quiescent bladders where the amount of residual urine is not increasing, must be abandoned; and on any occurrence of bladder irritability a stone should be carefully searched for.

Hæmorrhage into the Bladder.—This is a complication of extreme gravity. If cystitis does not already exist, infection is practically sure to arise as soon as any amount of blood accumulates in the bladder. Hæmorrhage may occur spontaneously, but is usually due to rough or careless instrumentation. The site of the bleeding is frequently the prostatic urethra, whose upper wall may be lined with distended varicose veins; but it most often arises from a point on the prostate which is habitually abraded by the introduction of a catheter. Occasionally it follows upon the complete sudden evacuation of a distended bladder from the relief of the intravesical pressure, being then in the nature of a general ooze from the mucous membrane. Calculous concretions are at times the exciting cause. In any case, the surest method of prevention is the continued use of the utmost gentleness in all manipulations. There is little doubt but that some cases exist where even the most skillful and gentle surgeon cannot avoid provoking bleeding; but far more often it is directly due to culpable negligence or ignorance on the part of the person who attempts catheterization. The use of flexible or semi-flexible instruments is, as often before insisted upon, infinitely less harmful; and with their use hæmorrhage from traumatism is least likely to occur; in rare cases, however, its recurrence is most readily obviated by recourse to a metal catheter of large calibre and of an eminently fit curve—one that has been proved on previous occasions to enter with facility the bladder of this particular patient. The habit of employing metal catheters is, however, a pernicious one, and only a surgeon with the greatest patience, the deftest and lightest hand, should feel himself qualified to introduce one in cases such as this.

11 P

As mentioned above, hæmaturia at times supervenes upon the sudden complete withdrawal of intravesical pressure; so that this is a reason against the indiscriminate emptying of chronically distended bladders, in addition to the danger of syncope and renal complications.

Orchitis.—Orchitis is a complication to which some patients seem peculiarly liable, attacks recurring again and again, oftentimes from no apparent cause. Usually, however, the affection may be traced to infection from instrumentation, and is hence best prevented by limiting instrumentation as much as may be, or by avoiding it altogether, should this be practicable. Vesical and prostatic congestions should also be avoided by the methods already indicated on previous pages.

Renal Complications and Uræmia.—Finally, nephritis, surgical kidneys, and uræmia must be prevented if possible from becoming complications of this already sufficiently troublesome disease.

Carefully selected food, plenty of fluid, and good bladder drainage are the most important means by which renal complications may be avoided. Increase of renal pressure from damming up of the urine is one of the most unfailing causes of renal insufficiency; and is, of course, best prevented by securing a free outlet of urine from the bladder. For this purpose catheterization will usually suffice; but when kidney breakdown is threatened from backward pressure which cannot be otherwise satisfactorily overcome, I think there can be no doubt that permanent drainage of the bladder is indicated. If feasible, this should, of course, be procured through a permanently retained catheter; but should such a course not be possible, or should it have failed to avert the impending disaster, no hesitancy should be entertained about opening the bladder either suprapubically or through the perineum, and thus establishing an artificial urethra which will at once relieve the kidneys of injurious pressure. The choice between these two operations—suprapubic or

perineal—will be considered when discussing the treatment of complications.

By thus relieving the backward pressure on the kidneys, and by preventing the developement of cystitis, the renal condition of these patients will be kept as nearly normal as possible; and when this is the case, little fear need be entertained of their being overwhelmed by uræmic symptoms; but it is only by the strictest attention to the state of the urine on the one hand, and to that of the circulation on the other, that the kidneys can be maintained in suitable condition.

4. Treatment of Complications.

Cystitis.—Cystitis is treated both locally and constitutionally. The local treatment of cystitis may be considered under three headings: first, that by means of drugs acting through the kidneys; second, by means of irrigations of and injections into the bladder; and third, by means of drainage of the bladder.

In no cases of cystitis should the constitutional treatment be neglected. If the inflammation be acute, and extremely painful, rest in bed should be enjoined. The diet should be liquid or at most semisolid. Plenty of water should be taken. Hot sitz baths may prove beneficial, once or oftener in the course of twenty-four hours. The bowels should be well opened by mild cathartics or an enema.

In mild cases these means alone may suffice to effect a cure, in the space of one or two days. Where the pain is severe and incessant, an opiate may be required; if morphine is contra-indicated by the state of the kidneys, or other affection, some milder hypnotic and analgesic may be used. The bromides and chloral in combination often act well; hyoscine, chloretone, sulphonal, trional, or even paraldehyde, valerian, or asafœtida, may act beneficially.

The condition of the urine is an all-important guide to further medicinal treatment. Acid urine, as previously mentioned, is

best neutralized by reducing the amount of sugar ingested, dilut-
ing the urine by an increase in the quantity of fluid taken, and
by certain of the alkaline waters. Where the urine is alkaline
we may resort to the usual remedies, such as boric or benzoic
acid, sodium benzoate, urotropin, etc. As an exceptionally use-
ful urinary antiseptic I recommend salol.

The aseptic and regular employment of the catheter, to re-
move any residual urine, is frequently enough in itself to restore
the bladder to its normal state.

Combined with remedies such as the above, where the al-
kalinity of the urine is not readily overcome, or where there is
much pus or blood present, the bladder should be washed out.
As a rule, the best solution is the decinormal solution of sodium
chloride, which may readily be improvised by adding a teaspoon-
ful of common table salt to a pint of sterile water. The proper
solution consists of sodium chloride, one drachm and a half;
sodium bicarbonate, fifteen grains; and sterile water, two pints.
The use of drugs in the irrigation fluid is very rarely required;
but boric acid solution (five or ten grains to the ounce) may at
times clear up the urine sooner than the plain salt solution.
Silver nitrate should never be employed except in cases of chronic
cystitis; it may be commenced in the strength of one-quarter
of a grain to the ounce, and if well borne, and if it appears that
anything may be gained by such a course, the strength may
be run up to five or even ten grains to the ounce. Great care
should then be exercised that no part of so strong a solution come
into contact with the urethra, which would probably be much
irritated by it; but when acting on the transitional epithelium
of a bladder whose walls are further protected by thick layers
of mucus, and perhaps incrusted with salts, it does not seem
probable that any harm can arise. Potassium permanganate, in
the strength of 1 to 4000, is at times a useful drug.

The temperature of any solution employed should be between
90° and 100° F.; and it should not negligently be permitted

to cool unduly during the process of irrigation. The position of the patient should usually be supine; but where the post-prostatic pouch is large and difficult to drain, the pelvis may advantageously be raised six or eight inches.

The manner in which the bladder irrigations are given is important. It is very much better and more comfortable to the patient for them to be given through a soft-rubber or even a Mercier or English catheter; but where these cannot be introduced into the bladder, a metal catheter may readily be utilized by attaching a rubber tube to its outer extremity. Two methods of injection are used: the first by means of a syringe, holding at most one ounce, whose tip is carefully placed in the outer end of the catheter, which should be funnel-shaped for its reception; the other method consists in attaching by means of glass and rubber tubing, a small funnel, holding about an ounce of water, into which the solution is poured, and from which it is allowed to run into the bladder by the force of gravity. Where a syringe is used for the injection no force whatever should be used in pushing the piston home; indeed, it will usually be found that when the syringe is held vertically the piston sinks upon the contained fluid by its own weight. When the tubing and funnel apparatus is employed (and it is the more convenient when available), the funnel should never be raised to a height of more than two feet above the patient's bladder; usually the fluid will run easily at a height of a few inches. Whichever apparatus is used, not more than four ounces at the outside should be thrown into the bladder at any one time; when this quantity, or less if pain be caused, has been injected, it should be allowed to remain for ten or fifteen seconds, and then let out; nor should the abdomen of the patient be kneaded too vigourously in an effort to hurry the process. It is a form of treatment that requires patience and time, and nothing is to be gained by haste. The bladder should not be refilled more than four or five times at the same sitting, and the operation should not be repeated, except in offensive cases, oftener than once in twenty-four hours.

Contrary to the general rule above stated, to the effect that
not more than four ounces of fluid should be injected into the
bladder at once,—which rule, however, I invariably adopt at
the first irrigation,—I believe that much good may accrue from
the passive but very gradual distention of chronically inflamed
and contracted bladders. Thus I have seen patients who at
the first sitting could not bear to have more than a single ounce
thrown into their bladder at one time, subsequently, in the course
of a few weeks, regain lost bladder capacity from that of one
ounce until three or four and finally six or eight ounces could
readily be retained; the patients meanwhile experiencing a corre-
sponding decrease in the frequency of urination. But the most
gradual distention in the world should be practised: I am quite
satisfied if I can establish a tolerance for a drachm or two
additional at each sitting.

In the practice of irrigating the bladder the attendant, and
the patient as well, will often lose heart from the apparent slow-
ness of progress in the relief of the cystitis; and many a time
the surgeon will feel tempted to throw a large quantity of fluid
into the bladder rapidly and with considerable force, in the
effort to clear its cavity of accumulating mucus and blood clots
by a process analogous to hydraulic mining; but let him beware
that he does not adopt such a practice! The sudden changes
in form to which such methods would subject the bladder could
but augment the inflammation, and might possibly cause the
rupture of some of the vessels in its walls, burst some thin-walled
sacculi, or carry infection into the ureters and on the way to
the kidneys. The bladder itself might even be ruptured. It
should be remembered that there is no expectation of mechanic-
ally ridding the bladder of the products of inflammation and
hæmorrhages; we are not even operating by a variety of litho-
lapaxy; and however pleased we may be when a quantity of
débris is spontaneously evacuated through the catheter, we must
not forget that our object is rather to prevent the persistence

or extension of the inflammation than to remove its products—
we hope that these may dissolve and be passed by the urethra
in the natural course of events.

But in some cases these means do not suffice to arrest the
cystitis; the introduction of a catheter is painful, difficult, or
even impossible; the bladder irrigations give no relief; renal
and uræmic complications impend, and urinary fever has already
set in. Under these circumstances no further delay should be
tolerated, but as soon as it is evident that ground is being lost
the bladder should be drained.

Of course, the simplest way by which this may be accom-
plished is by permanently retaining a catheter, so that its eye
projects just within the vesical cavity, and the urine is collected
and discharged drop by drop, just as it is received from the
ureters. It is important to have the catheter neither too far
in, nor yet too far out of the bladder: in the former case its
tip will cause great irritation of the vesical trigone, while in the
latter the drainage will be very imperfect. To ensure its being
in the correct situation, the catheter should first be fully intro-
duced into the bladder until the urine flows in a steady stream;
then it is to be slowly withdrawn until the urine stops running
entirely, which it does when the eye enters the urethra; and then,
finally, the catheter is to be pushed back again about three-
eighths or half of an inch, until the urine escapes through it by
drops.

But it is an exceedingly difficult matter to keep a catheter
permanently in the correct place. Many forms of self-retaining
catheters have been invented, but in my opinion there is not one
of them which is practically useful. The Nélaton catheter should,
if possible, be that selected for the purpose, as being perfectly
flexible it is less apt to cause irritation. Some degree of ure-
thritis is nearly unavoidable, but with inflexible instruments
not only is urethritis more likely, but every change in position
of the patient is liable to wound the prostate or the bladder;

besides which it is very difficult to secure such a catheter in place.
For rubber catheters the appliance shown in Plate LXIII (facing p.
132) may be used, when it is at hand. This consists of a caoutchouc
bridle attached at one end to the catheter at its point of entrance
into the urethra, and fastening at the other around the body of the
patient's penis. Where this is not available the catheter should
be transfixed with a double ligature, through the loops of which,
tied fairly close to the catheter on each side, strips of adhesive
plaster are to be adjusted and fastened in a spiral and inter-
lacing manner around the body of the penis. If a ligature can-
not be procured in an emergency, the catheter may be transfixed
with a safety-pin, and the adhesive plaster tied to that. Care
should be taken that the attachment of the plaster to the catheter,
in any case, is close to its point of entrance into the urethra,
thus preventing the catheter from slipping too far in, as well
as keeping it from falling out. Watson [245] has suggested an
ingenious method by which a piece of rubber drainage tube,
four or five inches long, and of slightly less calibre than the
catheter employed (so as to grip it firmly), is passed over this
latter, the drainage tube being split longitudinally into two
halves up to within an inch of its outer extremity, and these
lateral halves then being attached to the penis by adhesive plas-
ter in the usual manner. Mercier and English catheters may
be fastened in by means of a ligature or safety-pin as already
described; while a metal instrument is best secured by passing
the middle tails of a double T-bandage through the rings on
each side of its shaft.

The period during which the same catheter can be safely
retained without changing varies much in different cases, and
depends largely on the state of the urine; in some patients the
catheter will within forty-eight hours become so incrusted with
salts as to make its removal difficult. It appears that instru-
ments made of webbing are more liable to the deposit of salts
than the soft-rubber catheter, and this constitutes another ob-

jection to their use for such purposes. Even when no such trouble arises, the irritation to the urethra or bladder, or the pain experienced by the patient may render the removal of the catheter imperative within a comparatively short time. As a rule, one should not be left longer in place without changing than a week or ten days, unless surety exists that no crusts are forming. This question is best determined by previous experience with the same patient, although the condition of the urine may serve as a fairly reliable guide.

When changed at suitable intervals permanent drainage by a catheter may be continued almost indefinitely. Thus Bazy [15] kept a Nélaton catheter in the bladder for eighteen months, the patient not being confined to bed.

In some patients a catheter will not stay in place; it seems to work its way out either spontaneously, or slips from the urethra every time the patient changes his position in bed; while in others a catheter will stay securely in the bladder even when the patients are up and about, and leading a fairly active life.

When from any cause the catheter cannot be retained in the urethra and drainage of the bladder still continues to be indicated, cystotomy must be done.

This is a very much safer procedure than tapping the bladder and allowing the cannula to remain in place; and besides being safer, affords the surgeon the additional advantage of digital or even visual examination of the interior of the bladder and the prostate, as well as enabling him to proceed to the formation of an artificial urethra, should such an operation be indicated at that time. As a rule, suprapubic drainage is to be preferred; but in certain cases the perineal route is the better. By the suprapubic route the patient is subsequently less annoyed, no irritation of the sensitive prostatic urethra being produced by the drainage tube or catheter; a much more thorough examination of the bladder can be made; and for subsequent radical operation it is the route of choice. Moreover, drainage by the suprapubic

wound is often better than by the perineal, since the fistula is shorter, the route more direct, and plugging of the tube much less likely. But where the patient is extremely weak, the operation of suprapubic cystotomy is not usually advisable, offering, as it does, a mortality higher than perineal urethrotomy, both from the longer time required for its accomplishment, and from the additional shock entailed. Fortunately for the patients who have to submit to some form of cystotomy, those of them who have the severer grades of cystitis and in whom an operation of the gravity of even the suprapubic method would be dangerous, do not, usually, have prostates of very great size; and in these cases, therefore, the bladder is more conveniently, quickly, and safely reached through a median perineal urethrotomy than by the suprapubic operation. In patients, moreover, with very fat belly walls, the perineal route may be preferred. At the same time that drainage is instituted by the introduction of a tube through the prostatic urethra, it will sometimes be well, if the condition of the patient warrants the additional shock and the slight prolongation of the operation, to do a prostatotomy, or a digital dilatation of the prostatic urethra and vesical orifice, so as to ensure good drainage, and if possible produce a permanent cure of the obstruction. It is only in very exceptional cases that a radical removal of the prostate by either route should be attempted during an operation undertaken for the relief of the cystitis. Patients who are so gravely ill from cystitis as to demand a cutting operation for its relief, are in no condition to endure a prostatectomy.

The technique of both suprapubic and perineal cystotomy will be described in a subsequent chapter.

Retention of Urine.—(a) *Acute Complete Retention of Urine.*—As well said by Socin [212], this variety of urinary retention is in prostatics quite as serious an affection as strangulated hernia, and requires quite as prompt and efficacious treatment. The bladder may be very greatly distended by a small

quantity of urine, as it may have been chronically contracted and inflamed for a long time. The pain is indescribably terrible, and instantly grows worse; not only is rupture threatened every moment, but the damming up of the urine into the ureters and kidneys renders urinary fever and uræmia likely; and even if rupture of the bladder does not occur, peritonitis by contiguity may soon develope. Since, moreover, the most usual cause of this form of retention is a mechanical obstruction caused by congestion of the prostatic urethra or vesical neck, which congestion grows worse every moment the retention is not relieved, it is evident how idle it is to resort to those remedies, such as opium and the hot bath, which are so successful at times in the treatment of acute urinary retention due to spasmodic or even to organic stricture. In patients of the latter class the retention is rarely absolute—usually a few drops trickle through the strictures now and again; and the bladder, moreover, is apt to be in a less unhealthy state, than where prostatic disease has existed for a long time.

Hence the only rational treatment for this serious complication is immediate relief by the catheter. It is very rarely indeed that a catheter cannot be introduced, provided no false passages have been made in careless and forcible attempts to gain entrance to the bladder before the case is seen. The patient himself, in his agony of pain and imperative desire for relief, may have produced false passages which even the most skillful catheterization will be unable to elude; or another practitioner with greater zeal than dexterity may likewise have rendered the urethra impassable. But in virgin urethras, which have not before had a catheter passed, and where no strictures are present, a little persistence, and a good deal of patience and gentleness, will almost invariably accomplish the result desired.

The soft-rubber catheter is to be tried first; this failing, the Mercier should be introduced, and its elbowed beak made to closely follow the roof of the urethra; should this also be met

by an insuperable obstruction, the English webbed catheter, moulded to a proper prostatic curve, may be tried, first alone, and then with its stylet.   If passed with the stylet in its interior, the beak of the English catheter may usually be lifted over the raised vesical orifice of the urethra by partially withdrawing the stylet, as already described.   When efforts thus conscientiously made also fail, metallic instruments may be tried; but I believe that a skillful surgeon will rarely succeed with these where he has failed with the English catheter mounted on the stylet.   A hasty and impatient surgeon will no doubt often succeed in introducing by force, perhaps by tunnelling the prostate, a metallic instrument into the bladder, where a little more dexterity and less force would have brought the same result to pass by means of a semiflexible instrument and without injury to the bladder, prostate, or urethra.

Where strictures render the urethra difficult to catheterize, the usual manipulations employed in such cases should be employed.   These it is not necessary to describe in the present work. It seems scarcely requisite to add that wherever in genito-urinary surgery a catheter has been introduced only with the greatest difficulty, it should be allowed to remain permanently in the bladder until all acute symptoms have subsided.

If, finally, no judicious efforts succeed in gaining entrance to the bladder through the urethra, the bladder must be tapped. The time during which urethral instrumentation should be persisted in will, of course, vary somewhat with different cases; but, as a rule, I do not think such attempts should be prolonged more than a half hour or forty-five minutes.   Even this length of time will be injudicious where the retention has lasted for more than a few hours at most.

While I recommend tapping of the bladder as the next step, I recognize that it must be only a temporary expedient; since it is very exceptional for the power of voluntary micturition through a urethra so much wounded and inflamed as these usually

are, to return within any reasonable time; indeed, as already pointed out, where this acute retention is allowed to exist for any length of time, it is not impossible, indeed scarcely unusual, for chronic complete retention to follow from atony of the bladder; so that where a competent surgeon is in attendance, and the surroundings make it suitable, it is best to do a suprapubic cystotomy at once, forming an artificial urethra by McGuire's method; or if the bladder be very small and the abdominal walls thick, perineal drainage may be established, as indicated in the last section.

But where no facilities for such operations exist, the bladder may be safely punctured suprapubically, and immediate danger averted, and the patient's pain temporarily relieved. This procedure may be repeated a number of times without evil consequences, but, as long ago pointed out by Dittel [68], such treatment is really only a pastime for the surgeon, and is one which should be tolerated only until proper arrangements for cystotomy can be made. When the resort to cystotomy must be delayed, it may appear better to retain the cannula in the puncture than to reintroduce it every few hours.

In cases of acute retention it is usually inadvisable to extend the palliative operation of cystotomy to the radical removal of the prostate; but this procedure is not so absolutely contraindicated as when the same operation is undertaken for drainage in cystitis.

(b) *Chronic Complete Retention of Urine.*—If atony of the bladder exists in cases of this variety, as can readily be determined by the degree of force with which the urine is expelled through a catheter, it will be proper to make use of drainage of the bladder by a permanent catheter, in the hope that the chronic retention may be due to the atony alone, and not to mechanical obstruction by the enlarged prostate. By this method the bladder walls may in the course of a few weeks recover their contractility, as evidenced by increasing force in any stream (whether

of urine or irrigation fluid) expelled through the catheter. If
the atony be thus recovered from, it still remains to determine
whether the mechanical prostatic obstruction is too great to be
overcome by the restored bladder contractility. This question
is readily answered in the affirmative if, on discontinuing the
permanent drainage, the retention persists. In some exceptional
cases it will have been found at the very outset that no atony of
the bladder existed. Under either of these circumstances, then,
—whether vesical atony never existed, or whether it be easily
recovered from after relief of intravesical pressure by permanent
drainage,—it is evident that the retention is due to mechanical
prostatic obstruction. Hence the indication is to remove this by
radical operation.

If atony did exist, and yet was not recovered from after per-
manent drainage, we are confronted with another problem: Will
removal of the prostate be any more apt to relieve the vesical
atony than was the drainage of the bladder through the catheter?
I think this question may fairly be answered in the affirmative;
although I would hesitate to recommend radical treatment to a
feeble patient whose catheter life was satisfactory to him. For
there would still remain the risk that the radical operation would
leave him no less dependent on the catheter than he previously
was; but if his catheterism was painful, difficult, or unduly
frequent, and the patient himself was not too old and feeble
for any operation, I would be inclined to advise him to take
the risk.

(c) *Chronic Incomplete Retention of Urine without Distention
of the Bladder.*—Much of what was said in the early part of this
chapter under the general heading of catheterism, applies to this
complication. It is a nearly invariable accompaniment of every
case of enlargement of the prostate; and I think there can be no
question that the proper primary treatment is regular catheteri-
zation. When this becomes unduly frequent—more than four
or six times in the twenty-four hours; or exceptionally difficult

or painful; or when the patient is not in a condition to carry out this plan of treatment intelligently, then removal of the cause of the residual urine is indicated.

(*d*) *Chronic Incomplete Retention of Urine with Distention of the Bladder.*—For these patients the indications are first to restore the full measure of vesical contractility, and then to remove, if necessary, the obstructing prostate. But we are met at once with the objection that permanent catheterization, so effectual in reducing atony of the bladder in other cases, cannot be applied here, since the bladder is chronically distended, and such treatment would necessitate its sudden and complete evacuation. I am well aware that precisely this treatment in these or similar cases has been employed by so sagacious a surgeon as Cabot [41], of Boston; but his observations, though worthy of all consideration and most interesting, do not seem to me sufficiently numerous to overthrow the lessons of long clinical experience on the other side of the question. At least two of Dr. Cabot's patients suffered from fairly marked hæmaturia as soon as permanent drainage was instituted, the long-standing intravesical pressure being removed; and one patient became uræmic on the day after the permanent catheter was introduced. Both were so fortunate, however, as to eventually recover from their severe renal symptoms. Yet with the innumerable cases known for years, and still, I regret to say, occasionally seen, where the sudden withdrawal of urine from long overdistended bladders has caused surgical kidneys, uræmia, coma, and death, within a few days, I would myself be very chary in changing a plan of treatment founded on the dictates of experience for one unsupported, thus far at least, but by a handful of patients.

Hence the proper treatment still to be advised for prostatics with overflow from retention, is to remove only a few—four to six—ounces of urine at a time, repeating this procedure every four or five hours as may be required, and thus gradually to empty the distended bladder in the course of two or three days.

Or, if desired, more urine may be withdrawn, and partially replaced with saline or boric acid solution.

The above plan of treatment presupposes that the urethra is freely open to catheterization.   But this may not be the case, the urethra being obstructed by strictures or false passages.   If a catheter can be introduced, but only with difficulty, the surgeon may try to clamp it, and leave it *in situ*, allowing a few ounces to run off by removing the clamp every couple of hours.   But if no catheter of any kind can be introduced, a filiform bougie should be tried, as in the case of stricture unaccompanied by prostatic enlargement; when success attends these efforts, the filiform should be left in place, as the urine will satisfactorily and not too rapidly drain off along its track.   If no kind of instrument can be introduced, I believe the proper course for the surgeon to pursue is to perform suprapubic cystotomy (McGuire's operation), evacuate the urine, staunch bleeding from the mucous membrane of the bladder by the hot douche; and take the usual constitutional precautions against the developement of surgical kidney and uræmia.

Aspiration or tapping of the bladder may be thought by some a preferable course, only a few ounces being removed each time, and the operation being repeated innumerable times; but such a plan of treatment admits of no hope to the patient save the classical "meditation upon death"; for it is the most improbable thing in the world that the urethra will again become open to instrumentation before the "meditation" of the patient has passed into the reality.

Perineal section—by which I mean external perineal urethrotomy without a guide—which would be the only perineal procedure save Cock's operation available under such circumstances, is a difficult operation at the best of times, and its difficulties are not lightened by the existence of false passages and an enlarged prostate.   Moreover, in patients with retention and overflow the prostate is apt to be of considerable size, and entrance to the bladder from the perineum would be by no means so easy as from

above the pubis; nor would the facilities for douching the bladder or even packing its cavity, in case the hæmorrhage was profuse, be so ample as by the high route. Cock's operation—tapping the urethra at the apex of the prostate—is open to the same objections, except those concerning the difficulty of performance.

Calculus.—The most generally accepted plan of treatment for calculus complicating enlargement of the prostate is suprapubic lithotomy with prostatectomy in suitable cases as well; and it is that which I have myself employed, and which I think is still to be recommended. Not a few successes have been reported from operations by litholapaxy, and in several instances this operation has been followed immediately or after a few weeks by Bottini's galvanocaustic prostatotomy. (Chismore [46], Willy Meyer [162], Young [260], etc.) But although I have no doubt that in the hands of those surgeons habituated to such manipulations the outcome may be perfectly successful in certain cases, yet there remain other patients in whom the intravesical projection of the prostate makes this procedure out of the question, as of course it would also be where the urethra was not open freely to instrumentation.

Phosphatic calculus being merely a symptom of the enlarged prostate it is futile to expect removal of the calculus alone to effect permanent relief. (Keyes [133].)

In few words my position may be stated thus: that in those cases in which I consider the Bottini operation advisable I would not be adverse to doing litholapaxy; but as will be seen in subsequent pages I prefer to limit the Bottini operation to very exceptional cases.

Orchitis is to be treated as when arising from other causes. Instrumentation should also be discontinued.

Hæmorrhage into the bladder is best treated by hot irrigations, and permanent drainage, which may be instituted by means of a suprapubic wound if necessary.

Renal Complications and Uræmia.—For these complica-
tions the treatment in patients with enlargement of the prostate
does not differ materially from that habitually employed in other
cases.   Good bladder drainage is, however, more imperative,
as well as, unfortunately, more difficult to secure.   The per-
manently retained catheter, or suprapubic or perineal drainage,
may be employed, according to the principles already laid down.
If polyuria is a distressing feature it may be partially relieved
by reducing the amount of fluid ingested, and by promoting per-
spiration.   Care should be exercised that atony of the bladder
from overdistention does not arise.

In the later stages of renal affections, when the urine becomes
scanty or suppressed, the usual increase in ingested fluid should
be prescribed; and great advantage may be derived from the use
of saline solution by the bowel.   A pint is readily absorbed from
the colon in the course of an hour or so; the temperature should
be over 100° F.   In sudden emergencies intravenous infusion
of the decinormal salt solution may be employed, it being rarely
advisable to give more than two or three pints at once by this
method.   This fluid is probably absorbed nearly as rapidly
from the bowel as when given intravenously, and certainly more
rapidly than when administered by hypodermoclysis.

The steam bath should be employed in case of uræmia, or
when it is not available, pilocarpine should be given hypoder-
matically.   The tendency which this drug is said to possess of pro-
ducing or at any rate favouring œdema of the lungs is against
it; but in so great an emergency as uræmic coma this risk may
be taken.   The hydrochlorate is the best salt, and is prescribed
in doses of one-eighth to one-quarter of a grain.   Digitalis is of
use in increasing the action of the kidneys and heart.   Sparteine
is also an efficient diuretic.   The sulphate is employed in doses
of one-half to two grains.

Dry cups applied over the loins may sometimes be of service.

Much interest has recently been aroused by the proposal of

Dr. Cabot [41], of Boston, to treat patients with surgical kidneys by means of drainage of the bladder. This is really a revival of Mr. Reginald Harrison's [114] method (1887) of treating suppurative nephritis by means of perineal cystotomy; this procedure possesses the advantage, as pointed out by Mr. Harrison, of being equally applicable whether one or both kidneys are affected, or whether it is uncertain which of the two kidneys is diseased. It was a method commended also by Dr. F. S. Watson [245], of Boston, in 1895. But Cabot has called renewed attention to the subject, and, as already remarked, has reported six very interesting observations. In his patients, treated by permanent catheterization, there was in all marked improvement evident as soon as the backward renal pressure was relieved: the distressing polyuria was reduced from sixty or seventy ounces to nearly normal, and at the same time the specific gravity increased from 1005 to 1012 and 1015.

Dr. Cabot says he is well aware that this procedure is no new therapeutic measure, but he thinks its applicability to renal disease has not hitherto been sufficiently appreciated, although the good effects of Edebohls's operation in relieving renal tension are well known to the profession. For present purposes he took it for granted "that a patient with obstructive disease of the prostate and dilated bladder may be regarded as having some degree of interstitial nephritis if the urine is abundant and of very low specific gravity. If such a patient is suffering from anorexia, nausea, and dry mouth, either with or without psychical disturbances, these are to be looked upon as symptoms of uræmia due to this interstitial nephritis. If, in addition to these symptoms, he has a high fever and the urine contains pus, it is to be regarded as probable that he has pyelonephritis." The following summary of the results obtained is worthy of careful attention:

The first patient, a man of sixty-seven years, after using the catheter for some months, there being over twelve ounces of

residual urine, was taken seriously ill, with a temperature of 103° F.—apparently commencing pyelonephritis. By constant drainage the amount of urine was in the course of some weeks reduced from sixty or seventy ounces to less than fifty ounces daily, while its specific gravity increased from 1007 to 1023. Intermittent catheterization was then resumed.

In the second patient there was anorexia, dry mouth, much nausea, and marked somnolence. By constant drainage the return to normal was remarkably rapid.

The third patient, in much the same general state, had fever as well. His bladder was distended nearly to the umbilicus. Thirty-seven ounces of urine of very low specific gravity were withdrawn, and by continuous drainage the patient's health was after a period of two months practically restored, although the quantity of urine remained at seventy or ninety ounces daily, and its specific gravity did not rise above 1008.

The fourth patient, aged seventy-two years, had suffered for several years with crebruria, there being about twelve ounces of residual urine. A resort to catheterization once or twice daily produced in about two weeks' time symptoms of commencing pyelonephritis. Constant drainage was then begun. Hæmaturia developed, and the next day the patient became uræmic. Under proper constitutional treatment all unfavourable symptoms disappeared, but it was not until the seventy-ninth day that intermittent catheterization could be substituted for continuous drainage. His daily amount of urine remained at about one hundred ounces, of specific gravity 1012 to 1015.

In the fifth patient the chronically obstructed bladder contained forty ounces of urine. Constant drainage, while it produced transient hæmaturia, relieved the delirium, fever, and thirst. Three weeks later intermittent catheterization was begun. The urine at last report, over a year after the acute attack noted above, was forty to sixty ounces daily in quantity, of specific gravity 1017.

The last patient reported was in the early stages of chronic nephritis, with polyuria amounting to eight pints (128 ounces) in the twenty-four hours. When chronic retention set in, this amount was reduced to six pints, of specific gravity 1005. Constant drainage was instituted, and in one day the amount of urine drained off reached sixteen pints (256 ounces). This was gradually reduced to six pints, and finally to four pints (64 ounces) daily, while the specific gravity rose to 1012 and 1015.

It is thus seen what a very valuable means of treatment permanent catheterization in these cases may become: it will bring back some patients from the verge of the grave, and enable them sometimes to return to a life of intermittent catheterization (when they decline operative interference) in the enjoyment of excellent health.

LOCAL PALLIATIVE TREATMENT, INCLUDING URINARY FIS-
TULA, THE BOTTINI OPERATION, AND CASTRATION.

1. Urinary Fistula.—Some of the indications for this form
of treatment have already been considered—cystitis, unrelieved
by irrigations, catheterism, or permanent drainage by the catheter;
the various forms of chronic retention of urine; exceptionally
for acute retention, when passing into the chronic variety; and
as a preventative of Bright's disease and other renal affections.
Some surgeons have been so pleased with the effect produced
on the long-standing cystitis, and with the life of comparative
ease enjoyed by patients possessing an artificial channel for
urination, that they have proposed stopping all operative treat-
ment at this stage, and leaving their patients for the remainder
of their lives with artificial urethras. That such a course is not
in some cases an eminently proper procedure, no one would
be so injudicious as to assert; but that the surgeon should rest
content with it for routine treatment I think indefensible in the
extreme. As well might one argue for the permanence of a gas-
tric fistula in the presence of stricture of the œsophagus, of a
jejunal fistula with pyloric obstruction, or of a fæcal fistula
with disease of the colon or rectum; and be unwilling to admit
that in selected cases it was not only justifiable but absolutely
imperative to proceed to the cure of the œsophageal stricture,
the evasion of the pyloric stenosis, and the removal of the dis-
eased colon or rectum, with re-establishment of the natural chan-
nel of excretion.

It is for these reasons, therefore, that the treatment by urinary
fistula is considered merely a palliative remedy, to be employed
only where it is not proper to resort to radical treatment; chiefly

as an emergency operation; very rarely as the final form of treatment.

As mentioned before, my preference is for suprapubic cystotomy, with the establishment of an artificial urethra by the method of McGuire [155]. The reasons already given for this preference may be reiterated and enlarged upon in the present chapter.

In the first place, the results to the patient are more satisfactory than when a perineal fistula is established. When the artificial urethra remains as a permanent thing, the convenience and comfort of the patient are matters of considerable importance. Incontinence is rarely a sequel of the suprapubic operation; and when it does occur, is very readily obviated by the use of an obturator in the new channel. Where the artificial urethra is in the perineum incontinence is both more likely, and when it does exist no obturator will keep urine from dribbling out; and the wearing of a urinal becomes necessary, with the retention of a tube in the perineal fistula to conduct the urine to its receptacle; since were no tube retained the urine would trickle down the thighs.

The mode of making urine, moreover, is usually more convenient through a suprapubic than through a perineal fistula. In the former case, if the patient is not able to expel his urine in a parabolic stream, much as in the normal state, a soft-rubber catheter is very readily dropped into the bladder, and with a slight primary contraction the remainder of the urine is evacuated by syphonage. Patients with perineal fistulæ are very seldom satisfied with their method of urinating, which I have heard them compare to that of a cow.

By the suprapubic route the inflamed vesical neck is not injured, either at the time of operation, or in the subsequent treatment of the patient. Better opportunity is afforded for examination of the interior of the bladder, and for the evacuation of calculi, pus, mucus, and blood clots.

The route for drainage of the bladder and for post-operative irrigation is more direct; larger tubes are used for drainage, and as a consequence the drainage is better, the tubes are less likely to become obstructed or kinked; and the convalescence is pleasanter for the patient.

The prostate is usually so large as to make access to the bladder from the perineum difficult, and as to render drainage of the post-prostatic pouch by this route ineffectual. The bladder is usually dilated and carried well above the symphysis, so that it is much more readily reached by the high operation.

But there are certain cases, few in number I acknowledge, but still worthy of consideration, where bladder drainage is indicated, where it cannot be obtained satisfactorily through the urethra, and yet where the bladder is small, thick, contracted, and very difficult of access by the hypogastric route. In these patients, as a rule, the prostate is small and sclerosed, and does not obstruct urination so much by its size, as by rendering the neck of the bladder immobile. In cases such as these, the advantages possessed by the perineal route are obvious.

It appears to me, then, that cystotomy for enlargement of the prostate is a very valuable operation, not lightly to be discarded. It is a step between catheterism and prostatectomy; and while it should, on the one hand, never be undertaken without the hope of being able to cure the patient at a later time by the radical operation, it should yet always be done in such a manner that, if further interference should subsequently seem inadvisable, the patient will nevertheless recover with an artificial urethra worthy of the name.

When employed only in selected cases the operation of forming an artificial urethra is attended by a very slight mortality. I am not aware that statistics of the perineal operation have been published, but the following table gives the results of McGuire's operation (in cases presumably selected) in the hands of various operators:

PLATE LXVI.
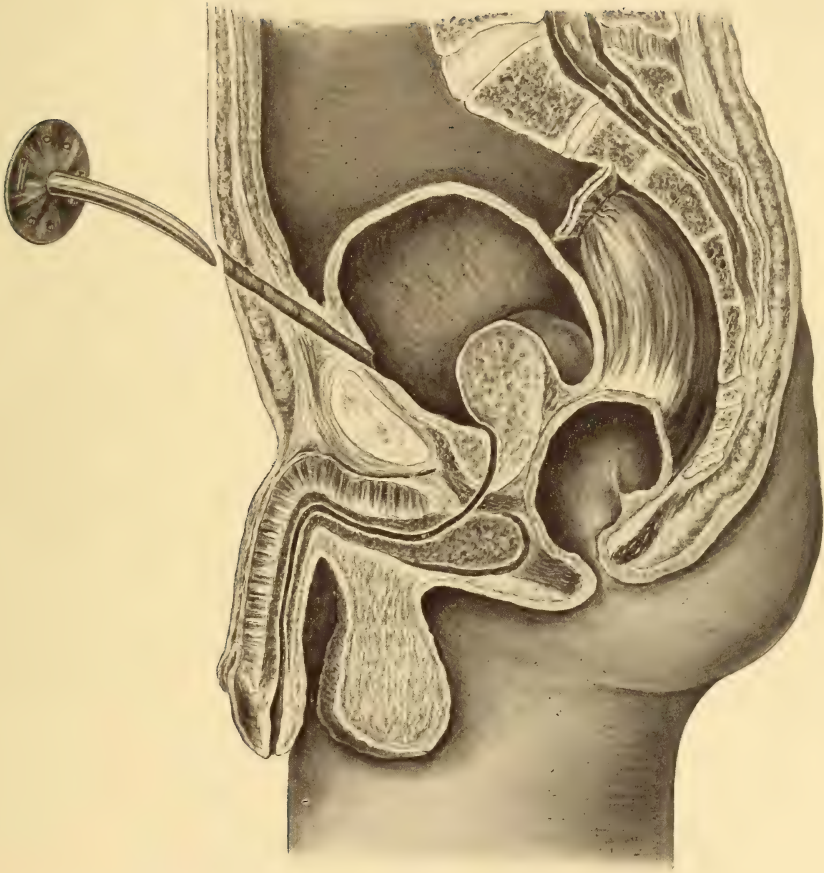
Suprapubic Fistula Established by McGuire's Method, showing the Obturator.

OPERATOR.	CASES.	DEATHS.	MORTALITY PER CENT.
Wiesinger [251]	24	0	0.00
Bjorn Hodernus [24]	20	0	0.00
Lagoutte [141]	21	4	19.00
Poncet and Delore [195]..........	39	2	5.12
McGuire [156]	39	2	5.12
Horwitz [126]...................	33	0	0.00
Total	176	8	4.54

Poncet and Delore [195] have called attention to the very much greater mortality which obtains among patients whose bladders are already seriously infected. Others they term the mechanical; but among the infected cases these authors record forty-two patients treated in this manner by Lagoutte, of whom fifteen died, a mortality of 35.7 per cent.; while of seventy-five such operations in their own hands, no less than twenty-nine terminated fatally, a mortality of 38.7 per cent. Watson [245] has recently published the results of 146 drainage operations by various surgeons, not classed as suprapubic or perineal, but probably including examples of both operations; of these, forty-nine terminated fatally, a mortality of 33.5 per cent. This high death-rate is probably to be explained in the same way as that which attends the infected cases of Poncet and Delore: because in these cases the operation is undertaken as a last resort, some of the patients being even moribund at the time, and the surgeon adopting this form of treatment as a forlorn hope, or as a means of producing euthanasia.

Technique of the Establishment of an Artificial Urethra by Suprapubic Cystotomy.—This operation may readily be performed under local anæsthesia with cocaine, if desired; but where the condition of the patient does not contraindicate a general anæsthetic, I prefer to use ether.

The bladder should contain from three to six ounces of fluid. Where the urethra is impassable the bladder will be distended by its retained urine. I do not distend the rectum, as I consider that this is unnecessary and that it exposes the patient to use-

less danger; instead, I have the patient placed in a moderate Trendelenburg position, the pelvis being elevated from eight to ten inches. When the patient is in the Trendelenburg position, indeed, it is scarcely necessary to have the bladder distended in any manner, as it becomes sufficiently accessible, merely from the falling away of the abdominal contents.

Distention of the bladder with air is employed by some surgeons as a preliminary to suprapubic cystotomy, and for the performance of the Bottini operation. Although it appears to be preferable to distention with water for the latter operation, yet it is not in any case devoid of danger. In a patient of my own, injection of air into the bladder produced subcutaneous emphysema of the penis; and in the hands of another surgeon I have seen emphysema of the belly wall as a consequence of this procedure. It has even been thought possible that injurious consequences to the ureters and kidneys might ensue. (See W. Meyer [164].)

The surgeon standing on the patient's right side, an incision about two inches long is made just above the pubis, to one side or the other of the linea alba, separating the fibres of the rectus muscle longitudinally. This lateral position of the incision decreases the chances of subsequent incontinence, as the muscular fibres keep the wound closed except when separated by the introduction of a tube.

The lower end of the incision should touch the symphysis pubis, and at the upper end the incision should grow progressively shorter as it is deepened through the abdominal walls. No vessels or nerves large enough to be named are divided, and hæmorrhage is insignificant.

The space of Retzius is now opened. The fat and cellular tissue which fills it should be carefully separated in the same line as the abdominal incision, deviating neither to the right nor left. Any large veins should be avoided. If cut, however, they will cease to bleed when the bladder is opened, but can be ligated if necessary. It is usually more expeditious, as well as produc-

PLATE LXVII.
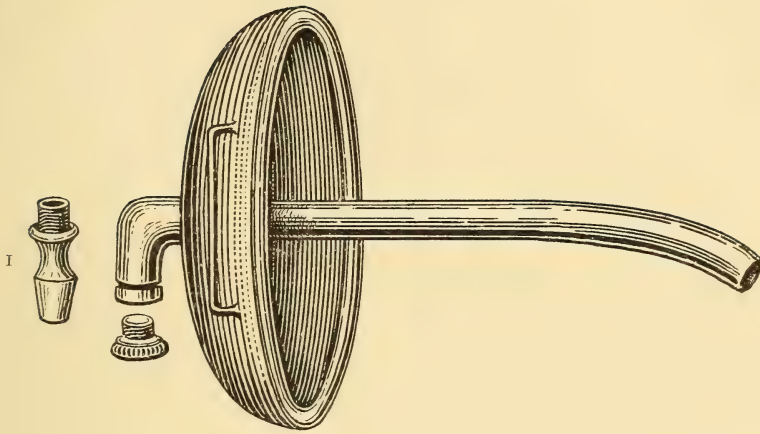
1. Stevenson's suprapubic tube.   2. Senn's sigmoid tube for suprapubic fistula.

tive of less disturbance to the parts, to dissect through this tissue with blunt-pointed scissors. Tearing it apart with the handle of the scalpel or the fingers contuses it so that it is more liable to infection from the urine.

The bladder is readily recognized by its bluish appearance and its consistency. The reflection of peritoneum is seldom seen at all. If in the way, it is readily separated from the bladder by blunt dissection.

When the bladder is reached, a silk or silkworm-gut suture should be passed through the outer layers of its wall about a quarter of an inch on each side of the line of the incision. These are to be used as tractors, and may be looped, or caught with hæmostatic forceps. They are not designed to remain after the operation, nor to secure the bladder to the abdominal wall. Where the belly wall is thick, and the introduction of these sutures difficult, a single suture will suffice; this may then be placed in the line of the incision, at its upper limit; or a tenaculum may be used to steady the bladder, as originally recommended by McGuire [155].

The bladder being thus secured it should be opened at a point not above the upper margin of the pubis, the edge of the knife being turned downwards. The incision in its wall should be longitudinal, and amply large to admit the surgeon's index finger. Some of these bladders have very tough and thick walls, and the opening does not dilate as the finger is introduced. The finger should follow the knife into the bladder before much of the intravesical fluid has escaped, as it will thus be able to gain a much more accurate idea of the interior of the bladder than when this viscus has become empty.

Unless the prostate has been injured previously or during the operation, hæmorrhage from the interior of the bladder is not apt to be severe. It is usually easily controlled by douching the bladder with hot water or salt solution. In extreme cases the cavity of the bladder may be stuffed with iodoform gauze, which may be pressed firmly against any bleeding point that can be discovered.

Any calculi present should then be removed, and blood clots, inspissated mucus, etc., washed out. For such purposes it may become necessary to enlarge the wound in the wall of the bladder; but it is well to avoid this when possible. It will very rarely be proper to prolong this operation into even a partial prostatectomy.

A good-sized rubber catheter—about number 35 to 40 of the French scale—or a drainage tube, should then be inserted into the bladder, down to but not touching the post-prostatic pouch. A double tube is necessary only when vesical catarrh is pronounced. If the tube is carried down too far, its end may become hermetically sealed by the bladder contracting on it. It is therefore well to have a tube with a lateral opening, as well as to avoid inserting it too far.

The retention sutures may then be removed, and the bladder in sinking back into the pelvis will carry the vesical opening of the new urethra even lower than before. The tube may have to be inserted more deeply at this stage of the operation.

The lower angle of the incision in the anterior sheath of the rectus should then be approximated with a couple of interrupted sutures of chromicized catgut or silk; and both angles of the skin wound sutured, so as, however, to allow the catheter to emerge higher than the middle of the original incision. In his later operations McGuire [156] employed no sutures at all, relying on careful placing of the tube to secure an artificial urethra of the desired obliquity. If the wound in the bladder have been enlarged beyond that requisite to admit the finger, it will of course be proper to apply a couple of sutures in that position. This may best be done in such a manner as to invert the bladder wall into the cavity of this viscus, thus producing a wound which is least likely to result in subsequent incontinence of urine.

The tube should be sutured to the skin on one side, to prevent it slipping in or out. A copious dressing of sterile gauze and absorbent cotton is then applied; and the tube connected by rubber tubing with a urinal beside the bed.

PLATE LXVIII.
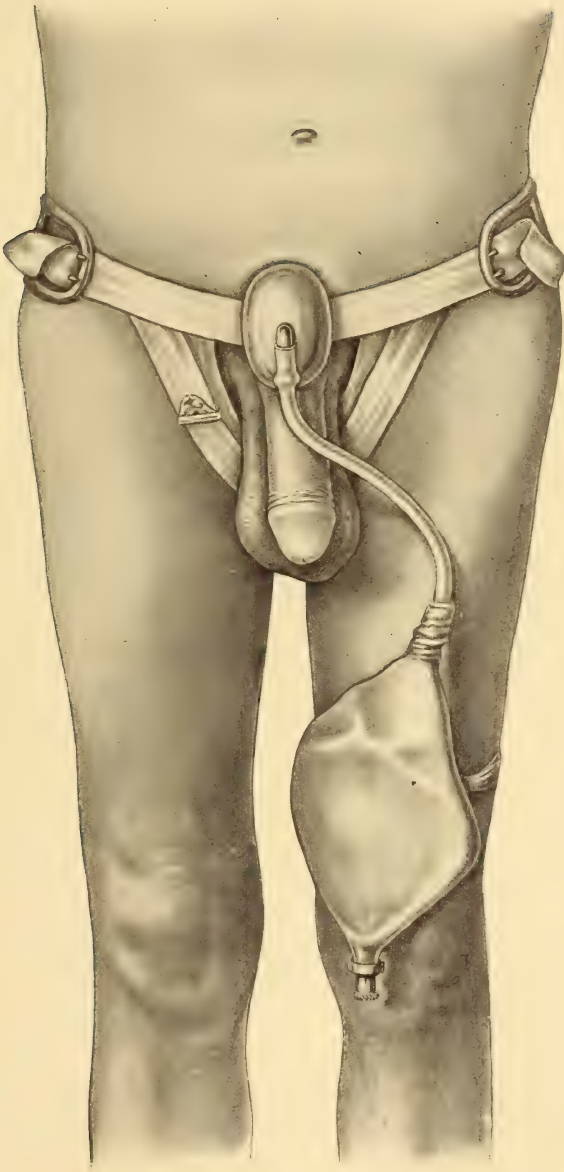
STEVENSON'S SUPRAPUBIC TUBE IN PLACE. WITH URINAL ATTACHED.—(*After DaCosta.*)

The urine should be kept scrupulously acid, both before and after the operation. For this purpose Dr. McGuire [155] thought nothing so efficacious as citric acid in the form of lemonade.

The patient may be allowed to sit up in bed as soon after the operation as he feels able; and may be let out of bed, as a rule, on the fourth or fifth day.

If the drainage tube causes much annoyance, it may be safely removed within six or eight hours after the operation; by which time the wound will have become thoroughly "glazed." The free discharge of urine through the suprapubic opening may be relied upon to keep the wound from closing; but it is better to leave the tube in the bladder for at least forty-eight hours after the operation. If it has, however, been removed earlier to relieve the patient, it can usually be replaced after the first day or two, if necessary, without producing renewed irritation.

Where the urethral obstruction is marked there is no likelihood of the artificial urethra closing; but where this tendency is observed, a good-sized tube should be constantly worn in the wound.

Where continuous drainage, as in cases of bad cystitis, is desired, one of the many forms of tubes with urinals attached may be employed, so that the patient will not be confined to bed. If the vesical irritability is great, and the prostate encroaches much on the cavity of the bladder, Senn's sigmoid drainage tube (Plates LXVII and LXIX) is probably the best variety. Stevenson's tube is another convenient form (Plates LXVII and LXVIII).

Where constant drainage is not required, but where the bladder is able to retain a certain quantity of urine and needs only occasional evacuation, McGuire's obturator (Plate LXVI) may be worn in the wound; although in some cases no involuntary leakage will occur even without this appliance, except when the level of the urine within the bladder becomes higher than the external opening of the artificial urethra, or when the patient assumes the supine position. On removing the obturator the patient

may be able to empty the bladder by voluntary contraction; but where the vesical atony is extreme the introduction of a catheter through the suprapubic wound will be necessary.

Technique of Perineal Prostatotomy for Treatment of Enlarged Prostate by Perineal Fistula.—This operation is even more readily performed under local cocaine anæsthesia than is the suprapubic; but where there is no objection to a general anæsthetic, ether is to be preferred.

It is well for the bladder to contain a few ounces of fluid. An ordinary grooved staff should then be introduced into the urethra, and the patient brought into the lithotomy position. I do not use stirrups to hold the legs, but have assistants support them in the desired position. It has always seemed to me a risk to flex the stiffened joints and atheromatous arteries of these decrepit old men to the extent necessitated by the employment of the usual forms of retention apparatus.

The surgeon then opens the membranous urethra in the usual way, by an incision about an inch in length, in the median line of the perineum, passing through the perineal centre. When the point of the knife is lodged in the groove of the staff, it is run forward into the bladder, dividing the anterior part of the floor of the prostatic urethra. When the bladder is entered, the left index finger of the surgeon should follow the track of the knife; and when the finger also has reached the bladder the staff may be removed. As the knife is withdrawn it should be made to incise the vesical neck, the prostate, and the prostatic urethra. The left index finger of the surgeon, which has never been removed from the bladder, may now determine by palpation the state of affairs in the interior of the bladder. Any calculi present may be removed with forceps or scoop, *secundum artem;* and the interior of the bladder douched through the perineal wound, to evacuate blood clots, mucus, etc. At times hæmorrhage may be severe, and the wound may have to be plugged around a tube.

PLATE LXIX.

SENN'S SIGMOID CATHETER IN PLACE WITH TUBE ATTACHED FOR CONSTANT DRAIN-
AGE INTO URINAL.—(*After DaCosta.*)

The left index finger should not leave the bladder until the permanent drainage tube is in place. In some cases it is well to further dilate the vesical orifice of the urethra by digital divulsion, with the two index fingers; or large-sized steel sounds may be introduced through the perineal wound, and the urethra be thus dilated.

The drainage catheter or tube, which should be as large as possible, and metal by preference, is then to be fixed in place. Its inner opening should be neither too far in, nor yet too far out. This may be determined in accordance with the principles given at page 151, when speaking of the fixation of permanent catheters in the urethra. If no metal or hard-rubber tube of the variety to be presently described is available, an ordinary large-sized English catheter or even a rubber drainage tube, without perforations, may be employed. It is to be remembered that the object of the operation now under discussion is to establish a more or less permanent perineal fistula, so the necessity of using a firm tube of large calibre is readily appreciated. The metal tubes intended for this purpose are provided with means of attachment by which they may be retained in the wound without trouble; but the webbed or rubber catheters must be fastened by a suture to both margins of the skin wound.

When the patient has been returned to bed, the perineal drain should be connected by glass and rubber tubing with a urinal hung beside the bed. If the grade of cystitis is severe, and the urine offensive, it is well for the end of the tube hanging in the urinal to dip into some antiseptic or deodorant solution. Of course, in reckoning the amount of urine drained off from the bladder the amount of solution already in the urinal must be subtracted. If the tube becomes clogged, or fails to drain for any reason, it should be flushed out with boric acid solution by means of a syringe, which is readily applied to the outer end of the perineal tube by disconnecting the glass and rubber tubing which passes to the urinal. This fluid for injection should not

be more than lukewarm if it is desired to dislodge clots of blood, on account of the coagulating powers of hot solutions. It is very rarely advisable, and, except in skillful hands, rather dangerous, to attempt to dislodge obstructions in the perineal drain by means of a probe or stylet.

The patient should stay in bed for at least six to eight days, the quiet being advisable so as to permit the fistula to heal soundly around the tube, before any occasion arises for its removal.

As before mentioned, if this operation is done in an emergency, as when it is required for retention of urine, a large-sized English catheter or a Nélaton catheter may be used for the perineal drain; but where possible it is better to have a metal or hard-rubber tube, which ensure better drainage and a more permanent fistula, because of their unyielding quality. Watson's perineal tubes [242] will be found very satisfactory (Plate LXX); and where the urine is ammoniacal and the tube is prone to become encrusted with phosphates, the appliance invented by Dr. Owens [186], and resembling in construction a tracheotomy tube, will be of value. Owens's tube, consisting as it does of two distinct parts, admits of the daily removal of the inner tube for cleansing, without disturbing the outer tube. Where a single tube of metal, webbing, or rubber is employed, it should be removed and cleansed once in a week or ten days, the intervals depending upon the state of the urine. English catheters must usually be discarded after a week's use; rubber tubes may remain good for several weeks with proper care; but metal tubes will practically never wear out.

After from six to twelve weeks the perineal tube may be permanently removed. If urethral obstruction still exists, the fistula will remain; but, unless incontinence of urine follows the operation, no tube need be worn, as urine will escape only at stated intervals, controlled voluntarily. If incontinence, however, is present, a tube with urinal attached must be worn constantly.

2. **The Bottini Operation.**—It seems uncertain whether the

PLATE LXX.
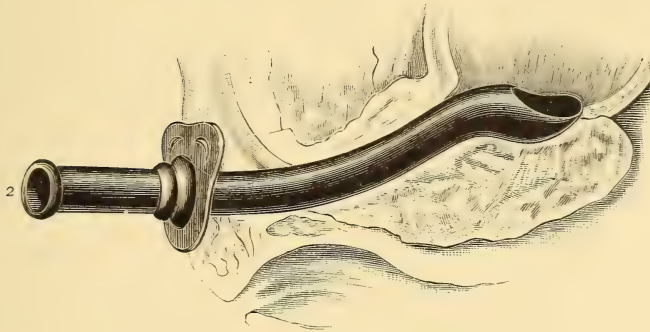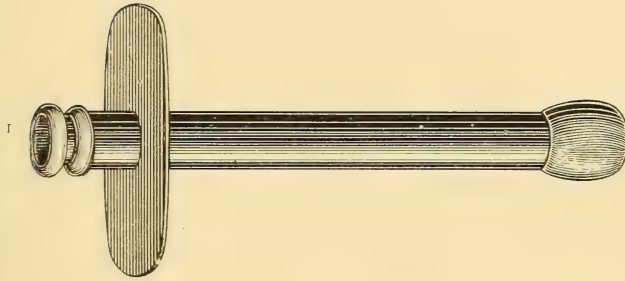
1. Owens's perineal tube. 2. Watson's perineal tube.

original aim of the inventor of this method of operating was merely to remove at the time of the operation, as Mercier [159] and others with cutting instruments had done before him, enough of the prostatic obstruction to cause a subsidence of the symptoms; or whether, as has been claimed by some, his design was to cause shrinkage and decrease in bulk of the whole gland during the process of cicatrization and contraction which necessarily ensues upon the cauterization.   Whichever was the original aim, there can be no doubt that at the present day the results are sought to be obtained through the process of cicatrization and contraction very much more than through actual burning away of barriers.

This fact gives us a clue to two of the chief characteristics of the Bottini operation—the imperfection of the immediate result, and the uncertainty as to the ultimate effect.   It depends very largely on the individual prostate whether the burning in it of grooves of certain (or uncertain) size will cause enough contraction during cicatrization to relieve the obstruction, will have no effect at all, or will result in such distortion of the part as to leave the patient worse off than before the operation.   And at the present day it next to never happens that the amount of prostatic tissue oxidized by the cautery during the operation is sufficient to immediately relieve the obstruction, without the action of the subsequent cicatricial contraction.

On account of these shortcomings, and of other objections which will be mentioned presently, many surgeons have denied that this operation has any place at all in surgery; while there are, on the other hand, quite as enthusiastic surgeons who deny that any other operation is worthy of trial in the treatment of prostatics.   Those surgeons who are open to reason, it seems to me, will take a middle course, and while recognizing the insuperable objections to this form of treatment as the exclusive operation for prostatic enlargement, will nevertheless admit its applicability to a limited—an extremely limited—number of cases.

13 P

Yet in spite of this wide divergence of opinion among surgeons, there are, fortunately, a few facts which are admitted to be true by both sides in this controversy. First and foremost among these is that the mortality of the operation is low. Watson [244] has recently summarized the results of 1086 Bottini operations performed by various surgeons. Among these there were 69 deaths, being a mortality rate of 6.3 per cent. Freudenberg [82], in 1900, collected 753 operations by this method, 44 of which, or 5.8 per cent., terminated fatally. This mortality rate, however, seems to me to be below the truth. It is less than the average obtained by seven of the most skillful operators in our own country and Germany, as will be seen presently, and is decidedly less than that which the general surgeon who does the operation only occasionally can hope to secure. Burckhardt [39] collected 75 recent cases, including his own, the average death-rate being over ten per cent., as seen in the following table:

OPERATOR.	CASES.	DEATHS.
Verhoogen	11	3
Pisani	1	0
Czerny	10	1
König	19	2
Roth	6	0
E. Burckhardt	28	2
	75	8

10.66 % mortality.

Another fact generally admitted both by those favouring and by those opposed to the Bottini operation, is that the mortality rate grows progressively less as the number of cases operated upon by any one surgeon increases. That is to say, that individual dexterity and practice have much to do with the success of the operator. What Keyes [133] said in regard to litholapaxy may be applied with equal force to this operation: that a general surgeon will perform a cystotomy, a lithotomy, a prostatectomy, as well as any other cutting operation, because these operations are a part of general surgery; but that he will not perform a Bot-

tini operation as well the fifth time he does it as he will the fiftieth; whereas there will be no difference between his fifth and fiftieth lithotomy, either in its performance or its result. And I have great regard for a surgeon like Finney [79], of Baltimore, who expressed such Hallerian diffidence, that, as he said, he did not "dare" to perform this operation himself, when he saw such excellent results from it in the hands of one of his colleagues. But even in the hands of those who are acknowledged to be most skillful in its performance, the aggregate of deaths does not fall below the average mortality as given by Freudenberg and Watson, as a glance at the following compilation of late statistics will show:

OPERATOR.	CASES.	DEATHS.	MORTALITY PER CENT.
Bangs [12]	34	3	8.8
Burckhardt [39]	28	2	7.1
Freudenberg [84]	51	4	7.8
Horwitz [126]...................	95	3	3.1
W. Meyer [165]	59	7	11.8
Young [260]	41	3	7.1
	308	22	7.1

Hence the Bottini operation cannot be regarded as the perfectly innocuous procedure some surgeons would have us believe it to be. It is slightly more dangerous as an operation, other things being equal, than the formation of a suprapubic fistula; but its death-rate even in the hands of experienced operators is not less than that of perineal, and is inconsiderably less than that of suprapubic prostatectomy.

Beyond these primary facts, on which there is practical agreement, the advocates of the Bottini operation deny, or at any rate ignore, the force of the many objections raised against this form of treatment. The main objections which it appears to me are inherent in this operation, as an operation, and quite apart from the question of its applicability to every case, are the following:

(a) *The special requirements of the operation.*

1. The need of special apparatus. With no other form of

treatment is special apparatus required. The various forms of drainage tubes and obturators, urinals, etc., used when an artificial urethra is established, are not needed for the operation, but for the after-treatment; they are not indispensable, and when required are inexpensive. In prostatectomy only the instruments employed in general surgery are required. But for the Bottini operation not only is the galvano-caustic incisor to be purchased, at a cost of fifty dollars or more; but a battery, or a transformer, even more expensive, must be acquired; and a cystoscope for preliminary examination is also advisable. These things may be very readily obtained and manipulated in a large city hospital, but are very difficult, sometimes impossible, for the general surgeon to procure.

2. The need of special knowledge of electricity in general, and of the mechanism of these instruments in particular. To one who has grown up with electric currents in constant use all about him, these matters come easily; but electricity is not even yet so universally used that every surgeon is familiar with its applications. The apparatus is difficult to keep in order even when attended to by expert electricians, and as it is prone to prove a failure at the eleventh hour, their services are not always obtainable.

3. The need of special skill and dexterity in endourethral and intravesical surgery. Every operation, to be sure, requires special skill and dexterity of some kind; but an experience and manual dexterity sufficient for safe operating in all kinds of abdominal surgery will be obtained by the performance of ten or fifteen operations for acute appendicitis with its complications, very much more easily than will dexterity for the successful performance of a Bottini operation be acquired by an even greater number of cystotomies or lithotomies. The remarks of Keyes [133], quoted above, in reference to litholapaxy, are applicable to this point: the surgeon who is fit to perform a Bottini operation with surety is he who has had great experience with the cystoscope, with Bigelow's apparatus, and with previous Bottini operations.

(b) *The uncertainties of the operation.*

1. As to the form and outline of the prostate. This objection may be partly overcome by the use of the cystoscope, where the state of the bladder and urethra will permit prolonged instrumental examination; but even thus the chance for errors in diagnosis is very great: a projection thought to be prostatic may turn out to be a fold of the bladder wall, and instead of burning grooves in the enlarged organ, the peritoneal cavity will be opened, as has happened to very skillful operators.

2. As to the position of the beak of the instrument. Many good and skillful operators have placed the beak of the instrument as desired, and have ascertained its position by palpation with a finger in the rectum; feeling themselves safe, they have then turned on the current, and, as just mentioned, the result has shown that the beak of the incisor was hooked over a fold of the bladder, and not in contact with the prostate at all.

3. As to the temperature of the blade. It is impossible to be sure that a current sufficiently strong to heat the incisor to a white heat outside of the bladder will accomplish the same result when the blade is within the bladder and in contact with the prostate.

4. As to the length and depth of the incisions. The length is roughly gauged by the scale on the shaft of the instrument; but if the beak "backs off," or is forced away from the prostate, instead of the knife blade sinking into the prostatic substance, a very erroneous impression may be obtained. The depth is more accurately assured by the use of Young's [260] blades of graduated sizes, but even thus absolute surety does not exist.

4. As to the amount of tissue destroyed. This follows directly from the uncertainty as to the heat of the blade and as to the length and depth of the incisions.

(c) *The accidents of the operation.* These it is impossible always to prevent, in the midst of so many uncertainties.

1. The apparatus may fail to work, although apparently in perfect order. This accident may occur either before the instrument is introduced, or even if the blade became heated properly then, it may fail to do so a minute later, when it has been passed into the bladder. Here the operation must be abandoned.

2. The incisions may be too long, or,

3. The beak may slip. In either case very serious accidents may follow. Freudenberg [81] burned a hole into the rectum. Young [260] burned through the membranous urethra, and had to do an external urethrotomy to check the hæmorrhage. The space of Retzius has been entered, causing fatal suppuration (König [137]); in a patient of Willy Meyer's [165] an anterior incision caused death from suppuration in the space of Retzius, although at autopsy no perforation could be found; in a patient of v. Frisch [91] severe suppuration occurred in this situation from perforation, but recovery finally ensued. Fatal peritonitis has been produced by direct perforation into the peritoneal cavity (Freudenberg [84]).

4. The blade of the incisor may bend. Bouffleur [31] states that this accident occurred to Czerny, who split the urethra from one end to the other in withdrawing the damaged instrument. According to Burckhardt [212], among others who have experienced this accident are Freudenberg, König, and Rydygier.

5. The cooling apparatus may fail to work, and the vesical neck and the urethra be charred before the less sensitive hands of the surgeon perceive the accident by themselves becoming blistered. In Freudenberg's [84] operation the bending of the cautery blade above referred to was caused by his momentarily loosening his hold on the instrument because it burned his fingers.

(d) *The limitations of the operation.*

1. It can be used only where the urethra is freely open to instrumentation. Hence in cases complicated by strictures, and where the prostatic urethra is much deformed, this operation is inapplicable.

2. It can be used for a smaller variety of enlarged prostates than any other operation. Those which obstruct by their bulk cannot be sufficiently reduced in size by it. Pedunculated out-growths, even with Young's [260] ingenious incisions, are not satisfactorily treated. Prostates which are still increasing in size will probably continue to do so after the incisions have healed.

3. It does not admit of the proper treatment of other patho-logical conditions at the same sitting. Calculus except in rare instances is more satisfactorily and safely removed by lithotomy than by litholapaxy; and even were the case to be deemed a suitable one for litholapaxy, this operation might be impossible until the prostatic obstruction had been overcome. Sometimes the very presence of calculus is masked by the enlarged prostate; and even after a Bottini operation the prostate might still be too large to permit of litholapaxy.

Drainage of the bladder is very imperfect after a Bottini operation, and where it is particularly indicated this form of treatment cannot be too highly condemned.

(e) *The dangers in the after-treatment.*

1. Retention of urine. The prostate may swell up so much after the operation that not only can no urine be passed, but not even can a catheter be introduced to draw off the urine. Willy Meyer [164] and Freudenberg [84], among other surgeons, have experienced this complication, which necessitates puncture of the bladder; or, if the swelling does not soon spontaneously subside, a formal cystotomy. In v. Frisch's [91] patient a catheter was successfully passed after retention had existed for some time.

2. Secondary hæmorrhage. It is impossible to determine when this complication is to be anticipated, and hence to guard against its occurrence. It may occur spontaneously on the separation of the sloughs, or may be caused by the necessary passage of a catheter for retention. It has occurred several

times when a permanent catheter left in the bladder after the operation has been first withdrawn. The hæmorrhage may be severe, and may even require suprapubic cystotomy with douching or packing of the bladder to relieve it.

3. Sloughs may plug the urethra or catheter.

4. Sloughs may be retained in the bladder, causing foul cystitis, or intense suffering.

5. The liability to epididymitis, orchitis, and other affections usually classed as "accidents" of the operation. Watson's [246] statistics show that after the Bottini operation 22 per cent. of the patients develope orchitis, recto-urethral fistulæ, or incontinence. The corresponding figures for perineal and suprapubic prostatectomy, the latter including also suprapubic fistulæ and the former perineal fistulæ, are 7.2 per cent. for the perineal operation, and 6 per cent. for the suprapubic.

6. The liability to sepsis. Over half of the deaths in Watson's [246] series were caused by sepsis.

Besides these objections to the operation itself, there is the paramount objection that its *results are less satisfactory* than those obtained by other methods of treatment.

1. In the first place, the *results are uncertain* As seen already, death may occur from perforation of the bladder when no apparent mishap during the course of the operation indicated anything wrong. Watson [246] found that nearly one-eighth of all deaths was due to this cause. This is the uncertainty as to the immediate result; but the uncertainty as to the ultimate result is even greater. In 13 per cent. of cases, according to Watson's statistics, the operation has to be repeated; while in 30.4 per cent. only do cures result, and "good results," not cures, form only 84.4 per cent. of the whole.

These figures also appear to be somewhat rose-coloured. According to recent statistics collected by Burckhardt [212], among 960 cases, from 73 to 77 per cent. could be classed as having

the urinary function restored or improved, and from 14 to 18 per cent. were without result. The following table shows Burckhardt's exact figures:

AUTHOR.	CASES.	RESTORATION OR IMPROVEMENT OF FUNCTION.	WITHOUT RESULT.	DEATH.
Wossidlo	110	73.6%	18.2%	8.2%
v. Frisch	127	75.6%	17.3%	7.1%
W. Meyer	164	75.6%	15.8%	8.5%
Stockmann	229	77.7%	14.0%	8.3%
Freudenberg	255	76.5%	14.9%	8.6%
E. Burckhardt	75	74.6%	14.6%	10.6%

2. Besides being uncertain, the *results are not permanent.* Relief may follow for a time, and the patient be classed as, and consider himself, cured. This state may last for weeks, or even for months; but it is rarely permanent. Sooner or later, in the large majority of cases, the symptoms return: some patients endure their troubles; others are persuaded into a repetition of the Bottini operation; and still others submit to a prostatectomy, which is in all probability rendered much more difficult as a result of the periprostatitis set up by the previous operation. A few die before their urinary troubles again become pronounced.

We may conclude, then, that the Bottini operation is one which only specially trained operators should undertake; which even in their hands has a mortality nearly as great as radical removal of the prostate; which is of extremely limited application, and is without result in about one-fifth of the cases that recover.

But there are undoubtedly a few points in favour of the Bottini operation, and an impartial consideration of these is required.

1. It does not require general anæsthesia. There are some patients whose condition is such that, while they require no emergency treatment, for which state one of the palliative operations already considered would be indicated, yet they are unable to endure the shock of a radical operation, entailing as it does

general anæsthesia. For such patients the Bottini operation seems well adapted, provided, of course, the objections already discussed do not apply to the patient in question: for instance, provided the cystitis is not so severe as to require drainage of the bladder. If a patient such as this failed to recuperate enough, after drainage had been instituted, to endure a radical operation, he could still be treated and probably improved by a Bottini operation, drainage of the bladder by the artificial urethra previously formed continuing as long afterwards as required.

2. Patients will often be willing to have a galvano-caustic prostatotomy done, when the idea of any cutting operation would make them aghast.

3. Temporary success by one such operation justifies its repetition in a patient unfit for more radical treatment. At times a patient is found who experiences less discomfort from the performance of a Bottini operation than from the examination of the bladder with a stone searcher. Freudenberg [84] says he has never had occasion to regret the repeated performance of this operation.

4. The comparatively slight liability to pulmonary complications and shock renders it a suitable procedure where these are more to be feared than sepsis.

5. The shorter period of confinement to bed required in favourable cases. Many of these patients may be allowed to leave their bed permanently on the second or third day. In the aged any confinement to bed is harmful, because it upsets long-continued habits at a time of life when any deviation from the usual routine is apt to be disastrous.

The class of patients, then, where I would recommend the employment of the Bottini operation is extremely limited. It is to be advised only as a makeshift, where no other form of treatment is practicable. I would not employ it in very early cases simply because I believe that most of the symptoms can be relieved by regular catheterization, which is less dangerous. The

malady of those patients "radically cured" by the Bottini opera-
tion performed within the first few weeks or months after the
developement of symptoms, is not exempt from the suspicion
of having been not enlargement of the prostate at all, but merely
congestion; and it is quite within the bounds of reason to sup-
pose that these same patients would have benefitted from an
equally radical cure, obtained with much less danger, by means
of intermittent or continuous catheterization extending over a
period of a few weeks.

In slightly more advanced cases, where the enlargement of
the prostate is undeniable, and catheterization has been pushed
to its limit, galvano-caustic prostatotomy may be the only form
of operation to which the patient will consent; and may there-
fore properly be employed as a *pis-aller* provided bladder drain-
age can be procured or is not required.

In fully developed cases the Bottini operation is useless.
The more pronounced the adenomatous character of the enlarge-
ment, the less can the Bottini operation be expected to prevent
a continuance of the overgrowth, and the more futile is its em-
ployment. Even in the fibrous form of enlargement, where the
Bottini operation would have a better chance of success, a peri-
neal prostatectomy affords a surer probability of cure; and
in any case where the diseased gland can be safely removed, it
is mere folly to waste time with an operation which is too dan-
gerous for mere palliation. Where the reward is higher, greater
risk may be justifiable; but the reward for the patient of this
class treated by the Bottini operation is not high enough.

Among patients very far advanced in the course of prostatism
there is one class where I am inclined to favour the Bottini opera-
tion. It is that where the prostate is small and sclerosed, and
where its removal by prostatectomy even in otherwise healthy
patients would be extremely difficult. Here I think a Bottini
operation may be fairly considered the best form of treatment,
provided further treatment than catheterism or bladder drainage

is indicated. It is like the old question of an incurable leg
ulcer—the only way to cure the patient is by amputating his
leg; but it is much more to the patient's advantage to have an
incurable leg ulcer all his life than to risk losing his life by so
crippling an operation. So with the old prostatic—it is often
better, much better, to let him eke out the remainder of his days
with catheterism or a urinary fistula than to risk snuffing out
his life at once by an operation with even the low mortality
attendant upon that of Bottini.

*Technique of the Bottini Operation of Galvano-caustic Pro-
statotomy.—Description of apparatus:* The original apparatus of
Bottini [27] consisted of an Incisor (Incisore prostatico) and a
Cauterizer (Cauterizzatore prostatico). With the latter he burned
the surface of the gland in various places, and with the former
he charred grooves in its substance. The cauterizer was em-
ployed chiefly in the treatment of chronic inflammations, and is
now almost universally abandoned; so that only the incisor need
be particularly described.

The galvano-caustic incisor is a metal instrument of the
general form of a stone-searcher, but consisting of two blades,
male and female, like a lithotrite. The instrument is introduced
closed into the bladder, and the male blade, which is heated by
a galvanic current conducted along its interior, is made to burn
grooves by withdrawing it from contact with the female blade.
The female blade remains fixed at the position in which it is
first placed, being hooked over the prostate in the desired situa-
tion; and the male blade, being shorter, burns a groove not so
deep as the position maintained by the female blade.

The cutting part of the male blade (the knife) was origin-
ally made of platinum; but by Freudenberg's modification it
was made of an alloy of platinum with iridium, which substance
became more readily heated, since it offered greater resistance
to the passage of the electric current. In Bottini's instrument
the current passed to and from the knife blade along two wires,

PLATE LXXI.
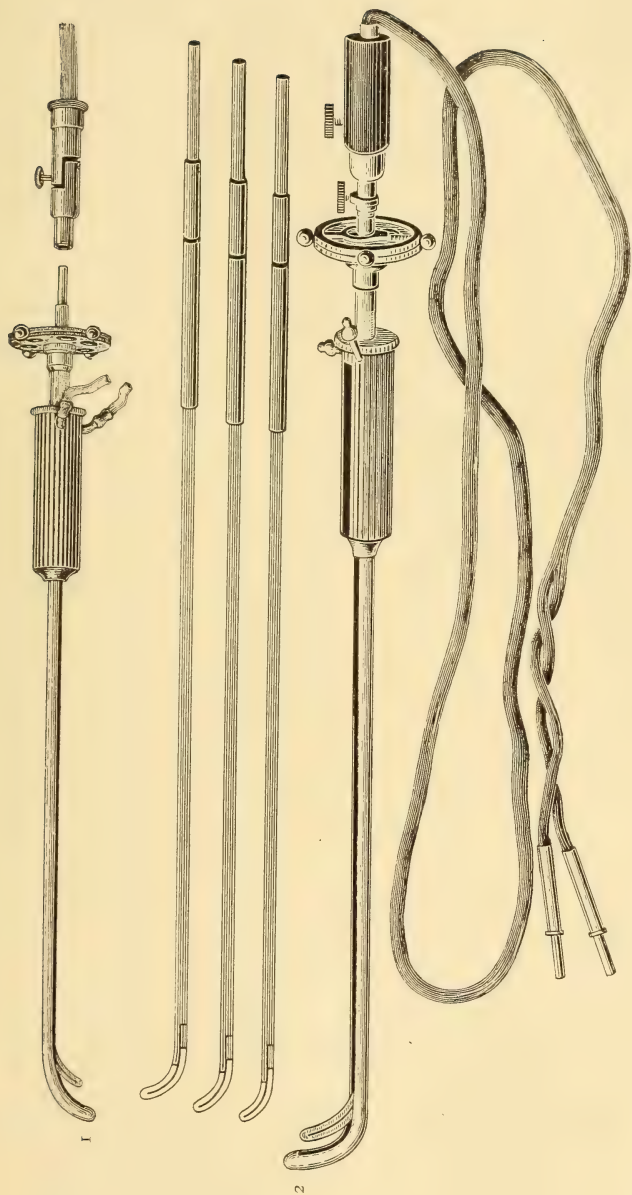
THE BOTTINI GALVANOCAUTERY.

1. Freudenberg's instrument.   2. Young's instrument, with blades of various sizes.

the knife being somewhat unsteadily fixed at their extremity. On this account the blade often bent when in use, and accordingly when an attempt was made to return it to its groove in the female blade, failure resulted. Freudenberg [80] attached the knife to a single strong wire, which would carry a stronger current than the fine wire formerly employed, and allowed of the firmer fixation of the knife. The return current passed through the shaft of the male blade. Even thus, however, the danger of the blade becoming bent is not entirely obviated.

It was found that not only did the current heat the platinum knife to a red or white heat, but that the whole instrument became so hot as to seriously injure the urethra, and to be very difficult to hold. Accordingly in 1882 Bottini added an appliance by which cold water was constantly passed through the interior of the shaft of the instrument, as far down as the platinum knife, so that the shaft was no longer dangerously hot. Freudenberg improved this arrangement so that the cooling stream flowed also through the handle of the instrument, which even in Bottini's modified apparatus became at times uncomfortably hot. He also made the handle more convenient to hold, and had the whole instrument so constructed that it is readily sterilized by boiling. The rubber tubing by which the cold stream is conducted to and collected from the incisor should be strong and quite resilient, so that by no possibility can it kink and interrupt the flow of water.

The knife-blade is withdrawn from its groove in the female blade by a screw in the handle, resembling an Archimedean screw; and a centimetre scale is attached so that the distance through which the knife-blade has been drawn may be readily seen.

Contacts for the electric current are also provided, with a separate screw to make and break the current. For producing the galvanic current a special battery is employed; or a transformer may be connected with the ordinary interrupted current of the incandescent light apparatus.

Dr. Hugh H. Young [260], of the Johns Hopkins University, has made some valuable modifications of Freudenberg's apparatus, the chief of which is an increase in the angle at which the beak is affixed to the shaft, so that the danger of the beak slipping while in use is minimized. He has also provided cautery blades of various sizes, so as to suit different degrees of prostatic overgrowth: these blades are readily interchangeable.

Still further modifications of the Freudenberg apparatus have appeared. Schlagintweit [206] introduced an instrument in which the knife-blade was brought forward by a sliding movement instead of a screw, being pulled back again to its first position by a spring. By this arrangement, which enables the entire mechanism to be controlled by one hand, the surgeon is free to retain a finger of the other hand in the rectum throughout the operation. Wossidlo [259], and subsequently other surgeons, have invented contrivances by which a cystoscope is combined in one instrument with the galvano-caustic incisor (Incisionskystoskop), by which it is expected that the surgeon can see every manipulation during the course of the operation. A separate current and set of wires is, of course, required for the cystoscopic mechanism.

Such modifications as the above, however, appear to me more ingenious than practically useful.

The Bottini operation was first performed with an empty bladder; but it was found impossible to thus avoid burning other parts of the vesical wall, so that this plan was abandoned. The bladder was distended with liquid; here the operator was between the horns of a dilemma: either the knife did not become hot enough to burn, or all the water became so hot as to be unendurable. Finally, at the present day, the operation is usually done after distending the bladder with air. For the disadvantages of this method, see page 170.*

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* Rosenstein [201 a] has recently called attention to another element of danger in the Bottini operation. He records the case of a man on whom Freudenberg operated by galvanocaustic prostatotomy, the bladder being distended with 200 ccm. of air. As

PLATE LXXII.
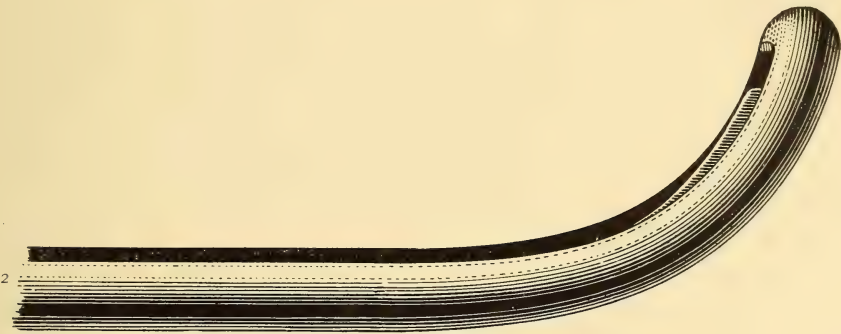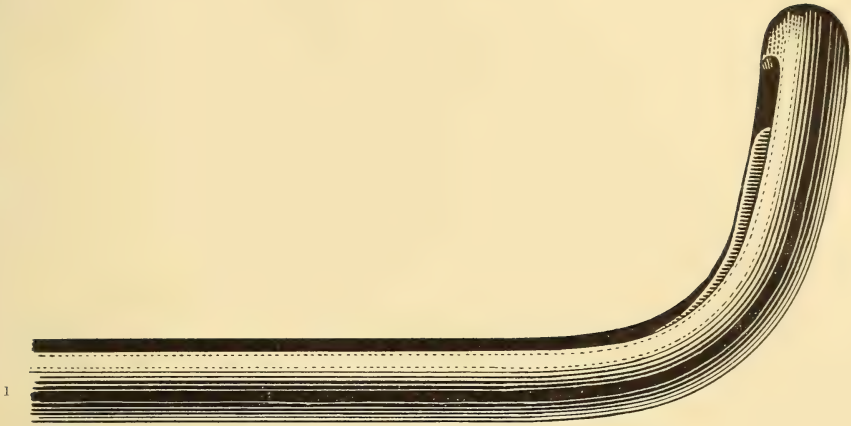
1. Young's incisor, 2. Freudenberg's incisor for the Bottini apparatus.

The operation: The patient should have his genitals shaved and cleansed, as in various emergencies a cutting operation may become necessary.

One and a half to two drachms of a one per cent. solution of cocaine (five per cent., if eucaine) should then be instilled into the posterior urethra. A cystoscopic examination is very desirable, but should, if possible, have been conducted on a previous occasion. It is valuable both from the visual information obtained, and because it will serve to show the degree of tolerance to urethral instrumentation. Where this is not well borne, the Bottini operation is not advisable.

In about five minutes' time sufficient local anæsthesia will have been obtained. The bladder should then be distended with a moderate amount of air, which is readily introduced through a rubber catheter by means of a hand syringe. The utmost gentleness should be used during the injection, and the bladder should not be fully distended. The patient's feelings are a safe guide. It is rarely requisite to inject so much air as to render the hypogastric note tympanitic; for it is to be recollected that the bladder is often small and contracted, and will bear very little distention. Previous experience as to its capacity for fluids is a help. It is of no use to employ sterilized air, as the microörganisms in the normal air may be safely disregarded. The danger of producing emphysema should be borne in mind.

Meanwhile, the instrument should be tested. The current is to be turned on, and the time and the strength of current required for the desired heat to be obtained carefully noted. It is usually thought best to operate with the blade at a white heat, but a bright red will suffice in the majority of cases, and is less likely to cause hæmorrhage. The blade is then to be tried, by

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the third incision was being made, an explosion like the bursting of a balloon was heard; laparotomy disclosed a ruptured bladder, which subsequent experimentation showed to be due to the "Leidenfrost" phenomenon—the condensation of steam on the hot incisor. The patient died from pneumonia on the eleventh day.

burning a piece of moist sterile gauze, to determine whether the heat will be maintained when the knife begins to incise the prostate. The cooling apparatus must also be tested.

This examination having been satisfactorily concluded, the blade should be allowed to cool before being introduced into the bladder.

When the instrument has been introduced, the surgeon must place the beak, inverted, over the prostatic obstruction, in the position previously decided upon; and should ascertain the correctness of its position by palpation with a finger in the rectum. If there seems to be any danger of the beak of the instrument slipping from its position during the operation, an assistant should keep his finger in the rectum throughout the procedures; or, which I prefer, the operator himself should keep his finger in contact with the beak of the instrument, through the medium of the rectum, and hold the shaft of the instrument with the other hand, entrusting to a skillful assistant the task of manipulating the screw to incise the prostate. The most delicate part of the whole operation consists in holding the female blade in the same unchanging position during the whole time that the male blade is incandescent. This task the operator should always assume himself.

Matters being thus arranged, the cooling current is to be turned on, and one assistant should give his entire attention to this feature of the operation, seeing that the return flow from the cooling tube never for a moment is interrupted.

Then the current contact should be made, and the time required to heat the knife be allowed to elapse before the incisions are proceeded with. It usually requires about fifteen seconds to bring the knife to a white heat; but it is well to allow a little longer time to pass than that found requisite outside of the bladder.

When the knife blade is believed to have acquired the requisite heat, the screw is to be turned so as to advance the male

PLATE LXXIII.
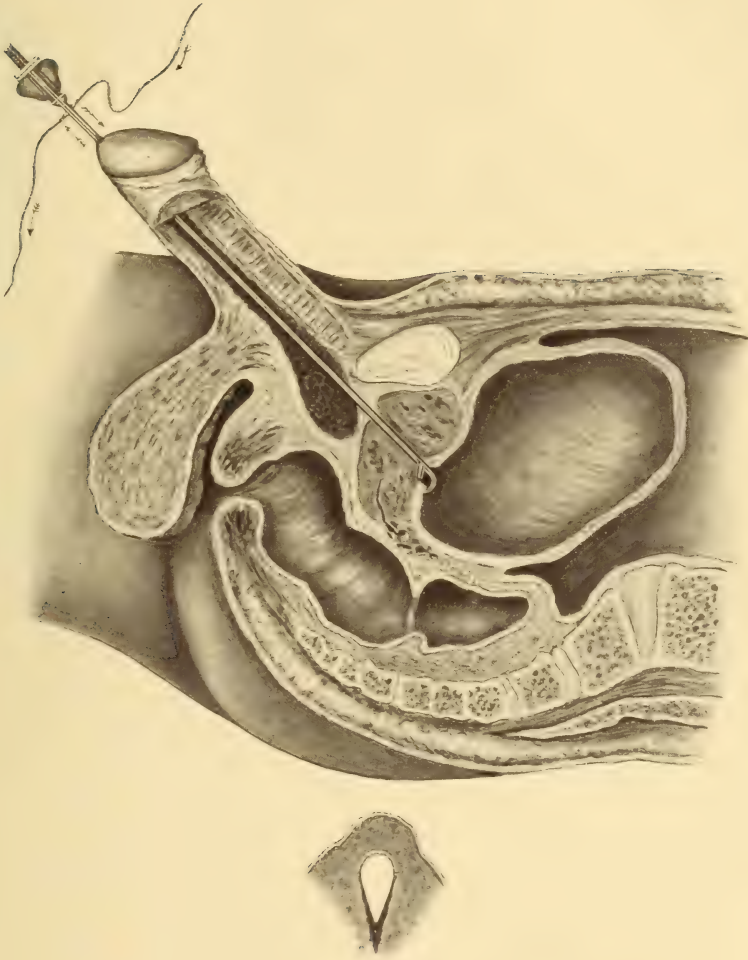
THE BOTTINI INCISION IN USE.

Below is shown a transverse section of the prostatic urethra after its floor has been divided
by the galvano-cautery.—(*After Socin and Burckhardt.*)

blade, from its position within the groove of the female blade, forward into the gland. The length of the incision will vary in different cases; it should rarely be more than two-thirds of the diameter of the prostate, and should never exceed three-quarters of this distance. Previous repeated instrumental and cystoscopic examinations will, as a rule, have given information as to the size of the gland sufficiently accurate for practical purposes. It is thus seen that the incision need rarely exceed three and a half or four centimetres in length. The depth can be regulated by making choice of a suitably sized blade from among those accompanying Young's apparatus. The rate at which the incision is to be made will vary slightly with the heat of the knife and the density of the gland; but, as a rule, a rate of one centimetre a minute is quite rapid enough. If an attempt is made to force the blade through the prostate at a quicker rate, it will often be found that the beak "backs off," instead of the blade advancing; or at least that annoying hæmorrhage occurs because the prostate is torn rather than seared.

When an incision of the desired length has been made, the knife-blade must be returned to its first position in contact with the female blade, and as this is done the current should be increased, so as to thoroughly consume any particles of prostatic tissue still clinging to the knife. When the male blade has again reached its place in contact with the female blade, the electric current is to be shut off.

Before making another incision the blade should be allowed to cool. The cooling current should continue in action between the making of the incisions, as well as during their formation. Some surgeons recommend removing the instrument from the bladder after the completion of each incision, so as to make sure that no particles of charred tissue adhere to the knife-blade; but I think that if the incisions are made deliberately and without force, and if the current is increased during the return of the knife-blade, this accident is not liable to occur; besides

14 P

which, the removal and reinsertion of the instrument produces unnecessary traumatism of the charred tissues.

I do not think that more than three incisions should be made. At times, one or two will be enough. An incision should never be made anteriorly, above the urethra, on account of the danger, already discussed, of burning into the space of Retzius. Usually one incision is made in the median line, so as to lower the vesical orifice of the urethra; if one lobe be more enlarged than the other, a second incision will be made into it, in a slightly radiating manner; and if both lateral lobes are much enlarged, an incision may be made on each side, in one of the forms indicated in the accompanying diagrams. (Plate LXXIV.) If the bar across the neck of the bladder be very thick and broad, two or three nearly parallel incisions should be made in it.

A pedunculated mass is not readily treated by the Bottini operation. If any attempt is made to cauterize it, either a failure results, or its pedicle is severed, and the prostatic tumor remains as a foreign body in the bladder. Yet Young [260] has managed, in a few cases, to burn through only the anterior part of the pedicle, by an oblique incision on each side, thus allowing the mass to fall backwards and gradually atrophy as a result of the interference with its blood supply.

At the conclusion of the operation, which does not last more than ten or fifteen minutes, the air should be allowed to escape from the bladder as far as it spontaneously will; the rest will be rapidly absorbed. Some surgeons, notably Burckhardt [212], have insisted on the propriety of leaving a permanent catheter in the bladder at the conclusion of the operation, on account of the fear they entertain of retention of urine setting in from œdema of the prostate and deep urethra. But I do not think such a procedure is advisable. In cases where this operation is to be employed, there should be no question of the bladder being able to take care of itself. If the tissues resent instrumentation, the operation should not be employed; or at least

PLATE LXXIV.
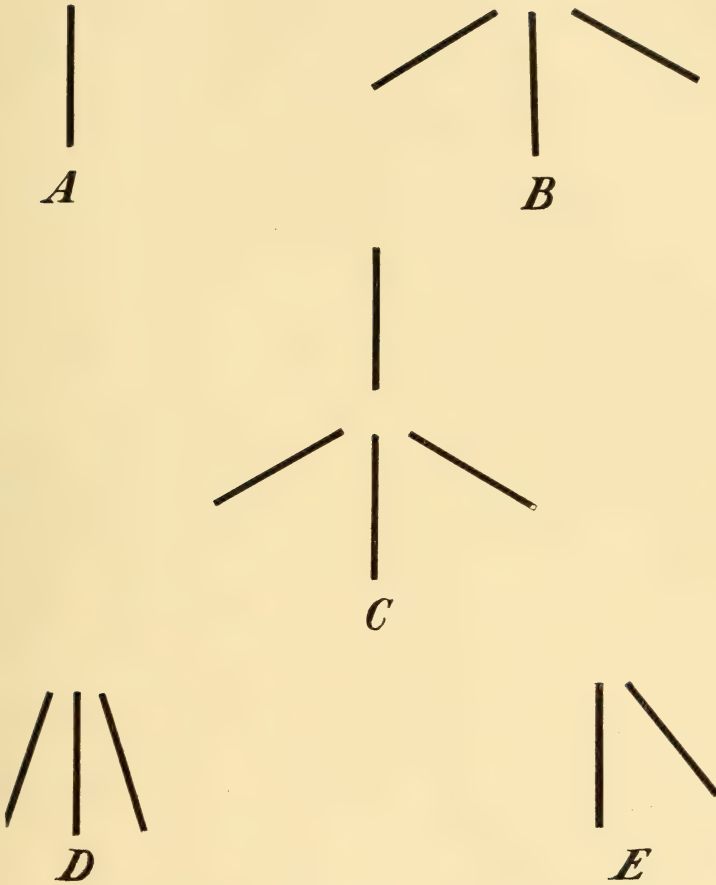
VARIOUS PROSTATIC INCISIONS USED IN THE BOTTINI OPERATION.

A. To divide a simple bar.   B. For general enlargement.   C. Showing an anterior incision which should not be employed.   D. For a very thick bar at the neck of the bladder.   E. For a prostate with enlargement mainly of the left lobe.

bladder drainage should have been previously provided for by the formation of an artificial urethra. Moreover, when a permanent catheter is retained, there is considerable danger of the sloughs clinging firmly to it, and of their being torn loose when it is removed, causing severe secondary hæmorrhage.

Nor am I in favour of the passing of sounds after a Bottini operation, at least until three weeks after the operation.

Secondary hæmorrhage, which, apart from sepsis, is the chief danger during convalescence, occurs most often during the second week; though some bleeding may be present from the time of operation; and in one case, narrated by Burckhardt [212], hæmorrhage did not appear until the sixteenth day, the first two weeks following the operation having been free from untoward symptoms. Catheterization, and every kind of urethral instrumentation, should accordingly be avoided, when possible, for at least three weeks. If retention of urine once occurs, it will be safer to leave the catheter passed *in situ*, and not to run the risk of having to frequently reintroduce it.

When hæmorrhage persists from the time of the operation, the retention of a soft-rubber or Mercier catheter, and irrigating the bladder with hot solutions, should be employed. At this stage of the convalescence it is rarely severe; but if at a later period is should be excessive, and if these measures should fail to check it, suprapubic cystotomy is indicated, with packing of the bleeding area. Or if it can be ascertained that the bleeding is urethral, external urethrotomy, with packing around a perineal tube, should be employed. But, as a rule, the suprapubic route will enable the surgeon to have better command of the situation.

3. Castration, etc.—Castration and the various operations on the structures of the spermatic cord, first brought prominently before the profession over ten years ago, were for a time widely employed in the treatment of prostatic enlargement. Castration was not only widely employed, but it was indiscriminately em-

ployed, and as a result the mortality rate was so high that the operation fell into great disrepute. According to one of its most enthusiastic supporters, J. William White [248], the mortality for this operation, when employed without due selection of cases, was at least eighteen per cent. Cabot [40] placed it at over twenty per cent. Other authors have published series of cases, gathered from various sources, in which the death-rate ranged from 11.5 per cent, up to nearly 20 per cent. Moullin's [176] personal operations, nineteen in number, included two deaths, a mortality of 10.55 per cent.; and Derjuschinsky [63], among fifteen cases had four deaths, a mortality of 26.6 per cent. These figures do not seem to justify Dr. White's expectation that the mortality from the operation would soon fall below seven per cent. He managed to reduce the mortality nearly to this point by elimination of cases which he considered unsuitable in the statistics presented by him before the American Surgical Association in 1895, but Dr. Cabot [40], the next year, pointed out that Dr. White's method of deducing results made the comparison with other methods of treatment rather unfair. Dr. A. C. Wood [257], five years later, in 1900, found that even in selected cases the mortality did not fall below eight per cent., unless it was "improved" by similar corrections.

As regards the restoration or improvement of function following the operation, the discrepancy among reported cases is even greater. According to Burckhardt's [212] tables, the cases collected by Englisch showed restoration of function in only 32.5 per cent. of the whole number; while of those collected by Cabot, 83.6 per cent. were reported as having had their urinary function restored. In regard to mere improvement of function, Cabot's figures gave 6.6 per cent., and Englisch's 47.5 per cent.; while no result was observable in 20.4 per cent. of the cases collected by Burckhardt himself, although in only 4.1 per cent. of Englisch's cases was the operation apparently of no effect. This wide variation in the statistics shows how very

PLATE LXXV.
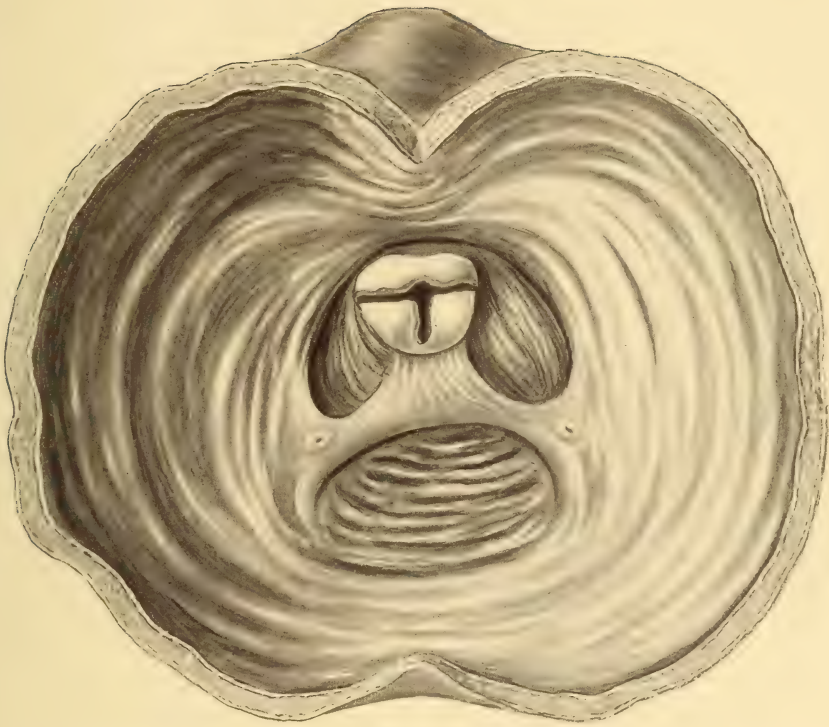
SHOWING BOTTINI INCISIONS FROM WITHIN THE BLADDER.—(*After Socin and Burck-hardt.*)

differently different writers will interpret results; and seems to render such figures perfectly useless.

One of the chief dangers after castration is the developement of mania, which seems dependent on the removal of the sexual organs, and not upon the mere fact of there having been an operation of some kind performed, as has been claimed by a few writers. It is pretty generally agreed that this complication is liable to occur in about one-tenth of the cases.

Unilateral orchidectomy is even less sure in its ultimate effect on the prostate than is the complete operation; for although the corresponding half of the enlarged organ has in a few instances shown very remarkable diminution in size, yet in the majority of cases no such change has been observed.

Vasectomy may be said to be slower, and but little more uncertain, in producing results than is double castration, while the mortality is somewhat less. Moullin [176] is of the opinion that the effect of this operation, as well as that of all others practised on the constituents of the spermatic cord, is due to reflex action on the nervous system, and thinks such measures more likely to be successful if the surrounding structures, containing the nerves of the cord and testicle, are considerably injured during the manipulations.

The sudden change from complete retention to voluntary urination at times experienced within a few hours after the operation cannot be attributed to actual atrophy of the prostate, but is almost certainly due to the diminution of congestion. It is extremely improbable that actual atrophy can set in until several months have elapsed.

It is in the glandular forms of enlargement that castration is more certain of effecting the desired result, and those who are still in favour of its employment are of the opinion that it should be limited to patients with fairly soft organs. One of the theoretical reasons originally urged for its adoption was the supposed similarity of the "prostatic tumors" to the fibro-

myomata occurring in the uterus; and as oöphorectomy for such affections was then popular, castration was looked upon by some as a not unreasonable remedy. And although we now know that the prostate is not the homologue of the uterus, and that the glandular overgrowth met with in the prostate is not similar in pathogenesis to the tumors growing in the uterus, yet the fact remains that in some instances double orchidectomy has caused marked diminution in bulk of the prostate, and great amelioration of the symptoms.

All these various sexual operations, however, have fallen into deserved disuse during the last few years, palliative treatment being more successfully applied by means of the Bottini operation, which was practically unknown in the nineties; while the different methods of prostatectomy have been almost universally adopted for radical treatment.

To my own mind, there is very little ground to dispute the theory that castration is surest in its effects on the normal prostate, and that the more diseased a prostate is, the less reason is there for it to be treated by castration. The case reported by Moses [172], and before referred to, where a patient developed enlargement of the prostate sixteen years after both testicles had been removed, is probably not the only one of its kind that has occurred. Tobin's [229] point of view is hard to understand: he advises castration where the sexual powers, or at any rate the desires, still persist; but recommends leaving the testicles alone and removing the diseased organ if no such desires are present; an opinion, I repeat, which is difficult to understand, unless we assume the above dictum to be correct, that castration is surest to affect prostates which most nearly approach the normal in condition. Some of the observations noted in the section on comparative anatomy may also be thought to support this view. For instance, the dog is of all animals the most prone to prostatic enlargement. It is also the only animal where castration at times fails to effect reduction in the size of the pros-

tate. These facts would certainly incline one to the belief that castration was more effective on the normal gland than on one the seat of pathological enlargement.

The paragraphs in Chapter V, dealing with the relation of the testicle to enlargement of the prostate, may be consulted in connection with this subject.

A number of years ago I myself adopted this form of treatment in several instances, with varying, but generally unsatisfactory results; but I do not think it too much to say that I shall never employ it again. I regard it as an operation absolutely indefensible at the present time.

For patients who are not able to endure the radical removal of their diseased organ, I consider one of the palliative operations already considered as the proper method of treatment; while for others either a suprapubic or a perineal prostatectomy offers the surest and safest cure.

INDICATIONS FOR RADICAL TREATMENT BY SUPRAPUBIC AND BY PERINEAL PROSTATECTOMY.

When palliative treatment fails, then a radical operation is indicated. We have before us a choice of two routes of access to the prostate gland, the suprapubic and the perineal; and a number of variations in the operative procedure by either route. To determine which of these many different methods is applicable to any given case, is the task at present before us. The technique of the operations will be described in the next chapter.

Those surgeons who would confine our operative technique to either the suprapubic or the perineal route alone, and who do not admit that in some cases one route may justly be preferred to the other, so that each is occasionally employed, appear to me to be very narrow-minded, and to be looking at the subject with prejudiced eyes. There is no more reason to my mind for one method of operating on the prostate being exclusively applicable to every case, than there is for one incision or one avenue of approach being always the only one possible in other conditions. For cleaning out the sphenoid cells it will sometimes be better to approach them from above, through the frontal sinuses, while at other times entrance will be more safely gained through the middle meatus of the nose. For draining the lesser peritoneal cavity it will at times be more advantageous to open through the left loin, while at other times the transabdominal route will be proper. For the operation of hysterectomy an abdominal operation will usually be preferred; but there are times when a vaginal excision will give better results. So with the operation of prostatectomy—the suprapubic operation is in certain cases (I think in the majority) in every way preferable to that through the perineum. No doubt a skillful surgeon will

in time become physically able to remove all, or nearly all, en-
larged prostates by one or the other route exclusively; but this
does not prove that in a certain few cases a resort to the neglected
route would not result in an easier operation, and in a surer
recovery as well. Mr. Freyer, who is inclined to the opinion
that all enlarged prostates are best removed by means of the
suprapubic operation which bears his name, nevertheless met
with one case (Brit. Med. Journ., 1902, ii, 248; ibid., 1903, i,
901) in which he was unable to remove the prostate by this route;
and the patient died a couple of days after the unsuccessful opera-
tion, of heart failure, the bladder being found at autopsy to be
full of clots. Now, this result is very far from proving that the
prostate in this individual patient could have been satisfactorily
removed by a perineal operation, but it certainly shows that no
one method can be exclusively employed, if we aim to secure
the best results. And since Mr. Freyer may be supposed to
possess more skill in the performance of his operation, as he
certainly has had more experience than any one else, it is but
reasonable to conclude that where he has failed, others will fail
as well. I once saw a distinguished surgeon in a neighbouring
city operate by perineal prostatectomy, and although he finally
did succeed in extracting the diseased organ, yet he sweat blood
throughout the operation, and there was for some time grave
anxiety as to the life of the patient. This surgeon is one of
those who advocate the perineal operation for every case; and,
as in the parallel case of Mr. Freyer, it may reasonably be sup-
posed that those surgeons who employ one operation exclusively
will be more apt to make it succeed in difficult cases than will
those who have no objection to resorting to a different method
when they think the one they usually prefer will fail. There
may be, indeed I have little doubt that there are, prostates which
can be removed neither by one route nor the other; but there
can, I think, be no question that that surgeon will do best for his
patients, as well as for his own reputation, who is competent to

resort to either method of treatment, as may seem indicated to him. I am glad to see my friend Dr. Senn [209] frankly admitting that he has encountered some prostates which could not be "shelled out," but which were only to be removed by morcellement.

Speaking in favour of suprapubic prostatectomy, and referring to Watson's [243] statement that the perineal distance was so great in one-third of the cases as to prevent the completion of the operation by the perineal route, McGill [152] said "it is unwise to commence an operation with the probability of failing in one-third of the cases"; and "it is not advisable to limit the ability to perform an operation to gentlemen with preternaturally long fingers"; while Dr. J. E. Moore [168], of Minneapolis, asserts that the operator's fingers grow longer as he grows in experience in the perineal operation. Both these surgeons' statements, while epigrammatic, are no doubt true; but they do not invalidate the principle, already laid down, that the ability to operate by both routes is a prerequisite for the most successful treatment.

This being accepted as an axiom, it will be the surgeon's next duty to determine which cases are suited to each method of operation. It will be recollected that enlargement of the prostate occurs in two main varieties—one variety, the glandular or adenomatous overgrowth, constituting the majority of cases; while the fibrous enlargement constitutes the minority, and even at times approaches more nearly in type to prostatic atrophy, or to sclerosis of the neck of the bladder, or is at least conspicuous by the relatively slight enlargement compared to the magnitude of the symptoms produced. In the former variety, as has already been pointed out, the prostate attains a greater size, and at the same time the bladder is more often dilated than contracted. In the latter variety, which seems rather intimately connected with inflammatory changes, the bladder is usually small and thickened. Hence at the onset we have the general law laid down that the hard, small fibrous prostate will usually be very

difficult of access by the suprapubic route, while the adenomatous organ will at times be so bulky as to absolutely prevent its removal through the perineum, except by fragmentation. It was in a case of the former variety that Mr. Freyer [86] found himself unable to complete his suprapubic operation, for although the gland could be satisfactorily reached, yet it could not be removed because of its intimate adherence to the surrounding structures. As has been frequently insisted upon by Mr. Freyer, the adenomatous glands gradually "shake themselves loose" from the surrounding structures, tend to resume their bi-lobed condition, and are easily enucleated by the finger. But where the organ is fibrous, and where periprostatitis (which usually has accompanied the developement of this variety) has existed, the adhesions between the prostatic capsule and its sheath are very dense, no natural line of cleavage exists, and enucleation is therefore difficult or impossible. Where prostates which approach the fibrous type (for a number are intermediate in character) are removed by enucleation, portions of the sheath, or even of the levator ani muscle, are frequently found adhering to the outer surface of the organ, it having been impossible to separate the capsule from the sheath on all sides. Yet in the fibrous prostates no subsequent increase in size is to be apprehended, and the removal of the floor of the urethra, together with as much of the lateral lobes as may be requisite, will result in sufficient lowering of the vesical outlet to accomplish the desired result; whereas a similar operation—a partial prostatectomy—in the case of an adenomatous prostate still increasing in size, would indeed give temporary relief, but might, on the other hand, be followed by continued growth in the remaining portions of the prostate, which would eventually cause renewed urinary obstruction. For such cases, therefore, complete enucleation is preferable, and that this may be more readily and satisfactorily accomplished by the suprapubic route I will presently endeavour to show.

But I think that this is the proper place to sound a note of conservatism. Many surgeons are rolling up long lists of successful (or unsuccessful) operations by either the suprapubic or the perineal route. But it appears to me that some such operators may be a little hasty in resorting to operative interference; and while one death from neglect to operate at the proper time is more reproach to a surgeon than several deaths which a timely operation merely failed to prevent, even though the former death never appears in his statistics; yet one death clearly caused or hastened by an ill-judged resort to operative treatment will demand an immense number of successes to blot out its remembrance. And I cannot but think that some surgeons are displaying more enthusiasm in adding ten or twenty operations every year to their tale of cases, than they are in seeking the best interests of their patients.

And in connection with these thoughts, I would like to insist upon the propriety of not doing too much at any one operation. If we open the bladder to drain it for cystitis, let us be satisfied, except in rare instances, if we secure the desired drainage, and let us not attempt to remove the prostate at the same time. If we open the bladder prepared to do a prostatectomy, and find a pedunculated outgrowth acting as a ball-valve against the vesical orifice of the urethra, let us be satisfied to remove it, and leave the remainder of the prostate alone. I do not think I can justly be accused of being a timid operator, but I am free to confess that I am afraid to do too much to some of these decrepit old men: their tenure on life is slight, and pressing our manipulations too far may at any moment loose the silver cord, and instead of curing our patient by a brilliant operation, we shall have killed him by meddlesome surgery.

I know quite well that in a certain number of cases removal of a pedunculated outgrowth has not prevented a return of symptoms; but, on the other hand, I am perfectly familiar with several instances where the most radical, dangerous, brilliant, and re-

markable operation in the world could have had no more suc-
cessful result than the simple snipping off of such a ball-valve,
with scarcely more present danger to the patient than that of
the anæsthetic. And inasmuch as Mr. Freyer, for whose auth-
ority and opinion I have nevertheless the utmost respect, has
recently made somewhat caustic remarks upon the futility of
employing anything else than total enucleation in any such cases,
I take pleasure in here recording the case of a patient of my
own (only one out of several) who was cured by this proce-
dure.

J. S., aged sixty-nine years, had been forced, for seven or eight
years, to rise during the night to urinate. The desire was im-
perative, and sometimes recurred ten or twelve times during the
same night. There was difficulty in starting the stream, and only
a small quantity was passed at any one time. Vesical tenesmus
occurred at frequent intervals, both day and night. On ad-
mission to the German Hospital, October 7, 1902, the patient was
found to be plethoric; his colour was sallow; his arteries were
somewhat atheromatous, and their tension increased. His
heart-sounds were muffled, and the second cardiac sound was
accentuated throughout. His lungs were emphysematous. There
was tenderness in the pubic region, and combined intravesical
and rectal examination demonstrated an enlarged "median
lobe" of the prostate. There were 60 cc. of residual urine. On
October 8, 1902, the pedunculated "median lobe" was removed
by suprapubic cystotomy, by means of large forceps. Bleeding
was free, but easily controlled. A rubber tube was inserted
through the suprapubic wound, which was not sutured. The
patient was discharged, well, in two weeks. I have heard from
him frequently since, and on recent inquiry ascertained that his
urination was normal in every respect.

Other similar cases are to be found in prostatic literature,
but they seem to have passed from the memory of many in the
profession. Burckhardt [212, p. 224] records the case of a patient

who had suffered from urinary symptoms for five and a half
years; and who for one year had had frequent attacks of re-
tention of urine.   By the removal of a projecting "middle lobe"
by suprapubic cystotomy, all the symptoms were relieved; and
when last seen, four and a half years after the operation, the
patient was in good health, and his urinary functions were nor-
mally performed.   Prof. Ashhurst [8] reported a case of similar
nature, as long ago as 1882.   The patient for five years had
been absolutely dependent on the catheter.   Finally the end
of his catheter broke off and remained in the bladder.   After
suffering for seven weeks from this added discomfort, he applied
for treatment.   The foreign body was removed by median peri-
neal cystotomy, and a pedunculated "median lobe" of the pros-
tate was removed at the same time.   On recovery the patient
found to his great delight that he could pass his urine in the
normal manner, and had no further use for the catheter.   Har-
rison [117] has recently reported another such recovery.

To these few instances others might be added, but those
given are sufficient to emphasize my point.

The *preferable route* for total enucleation of the prostate is
the *suprapubic*.   The prostate lies upon the triangular liga-
ment, and above the aponeurosis of Denonvilliers; neither of
these structures, so important in completing the floor of the
pelvis, is divided when the prostate is lifted off them, and de-
livered into the cavity of the bladder.   And when the prostate
is adenomatous in character its enucleation is accomplished with
surprising ease.   Whether the prostatic urethra is removed or
not makes apparently no difference in the functional result.   In
many of the modern perineal operations it is sacrificed in a similar
manner.   Indeed, Dr. Goodfellow's [98] procedure appears to
be precisely the same as Mr. Freyer's, except that the former
removes the prostate through a perineal incision, and is less able
to see what he is doing during the operation.

The approach to the prostate by the suprapubic route is

through structures which are less vascular, and less liable to permanent injury from the necessary manipulations. They are, moreover, not required for the function of urination. It is customary to cast in the teeth of the suprapubic operator the fact that he makes two incisions in the bladder wall, one on its superior surface, to enter its cavity, and another in its floor to reach the prostate; and it is pointed out by perineal operators that the organ whose removal we are attempting lies entirely outside the bladder, and that by the perineal approach the bladder wall is not divided. But those surgeons who, like Goodfellow, insist upon the propriety of entering the enucleating finger *into* the bladder cavity before beginning the enucleation, surely divide the floor of this viscus during their manœuvres; while those who, like Proust [196] and Young [261], approach the prostate from its lower side, employ an extensive dissection separating the rectum from the anterior structures, and dividing the base of, or working around the lower margin of the triangular ligament, and thus in either case form a wound which, as their results show, is more apt to result in a permanent fistula, while it affords no better drainage than is procured by the suprapubic operation. As has been pointed out by McGill [152] and W. G. Richardson [199], drainage is really better by the suprapubic wound; for it is a fact that where the bladder is drained both ways simultaneously almost all the urine escapes by the suprapubic tube, and that when both tubes are removed, the perineal tract closes first. This is, of course, where the perineal wound is a simple median urethrotomy, since, as has already been said, the wound left after a suprapubic cystotomy closes more rapidly than that resulting from the extensive perineal operations which are now in fashion.

As to the objection that the prostate is an extravesical organ, it may be replied that it is so to the same extent as, but scarcely more so than the appendix is an extraperitoneal structure; for the enlarged prostate (and it is only that form that we are discussing now) almost invariably becomes chiefly intravesical in

character, and it is therefore no more unsurgical to traverse the bladder to reach it than it is to attack the appendix by a transperitoneal route; and yet we all know that an inflamed appendix may readily, if circumstances require it, be stripped out from its peritoneal covering, leaving this in place like the empty finger of a glove, much as the perineal operators advocate scooping out submucous prostatic outgrowths from beneath the floor of the bladder without opening this organ; but nevertheless no one will prefer an extraperitoneal approach to the appendix. The enlarged prostate, in fact, is covered only by mucous membrane, or at most by attenuated muscular tissue which is as much prostatic capsule as it is bladder wall.

The mortality of Freyer's operation is higher than that shown by the statistics of the modern perineal operations; but of the cases that recover, those that are classed as good results form a somewhat larger, and those with perfect cures a considerably larger proportion.

FREYER'S OPERATION.

Operator.	Cases.	Deaths.	Mortality Per Cent.
Barling [13]	10	3	30.00
Deaver [58]	23	3	13.04
Freyer [90]	110	10	9.09
Horwitz [126]	11	2	18.18
Loumeau [146]	1	0	0.0
McRae [157]	3	0	0.0
Moynihan [178]	12	1	8.33
Stoker [217]	3	0	0.0
Wanless [241]	6	1	16.66
Wiener [250]	7	0	0.0
	186	20	10.75

PERINEAL PROSTATECTOMY.

Operator.	Cases.	Deaths.	Mortality Per Cent.
Albarran [2]	35	1	2.85
Deaver [57]	5	2	40.0
Ferguson [77]	6	0	0.0
Goodfellow [98]	73	2	2.74
Horwitz [126]	38	2	5.26

PERINEAL PROSTATECTOMY.—(*Continued.*)

Operator.	Cases.	Deaths.	Mortality Per Cent.
MacGowan [154]	28	4	14.28
Morton [171a]	10	2	20.0
Murphy [182]	48	5	10.41
Syms [221]	26	2	7.69
Verhoogen [233]	3	0	0.0
Young [262]	50	2	4.0
	322	22	6.83

I think I may be allowed, without false pride or modesty, to call attention to the character of my two fatal cases of perineal prostatectomy. The first patient was seventy-one years of age, but in almost desperate physical condition, being in the advanced stages of *paralysis agitans*. He had had urinary troubles for twenty years, extending back nearly to an attack of gonorrhœa at the age of forty-six. For the past six years he had employed a catheter, first every five hours, latterly every half hour. Recognizing that he was unsuited for an operation, I kept him in the hospital, and endeavoured to build up his system by diet, tonics, etc.; I also established permanent drainage by an inlying catheter, which he bore fairly well. After nearly two months, I operated, removing the prostate through the perineum by morcellement. The patient died in fifty-four hours, there having been no unfavourable local occurrences, such as bleeding.

My second fatal case was sixty years of age. He had had urinary troubles for ten years, rising two or three times at night. In August, 1901, his condition grew worse, and he had to pass his urine hourly, day and night. The residual urine was from 30 to 50 cc. The prostate was large, hard, tender, irregular, and the size of a small orange. He passed from 1500 to 2000 cc. of urine daily. On October 3d I did a Bottini operation. This gave him relief for five weeks. Beginning in February, 1902, he passed urine every fifteen minutes. To relieve this I established suprapubic drainage on March 3d. To my great

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regret this gave relief for only two days, when uncontrollable
tenesmus recurred, and he prayed for any operation for relief.
After waiting in vain for some improvement, but not wanting to
wait too long, in such circumstances, on March 18th I did peri-
neal prostatectomy. The patient died in twenty-four hours
from shock and suppression of urine.

Watson [246] collected from various sources 243 cases of total
suprapubic prostatectomy, with 28 deaths, a mortality of 11.5
per cent.; while among 530 total perineal operations he found
33 deaths, a mortality of 6.2 per cent. His tables showing the
comparative dangers and successes of these operations, as well
as those of the Bottini operation, are of much interest.

TABLE I.—RESULTS.

OPERATION.	CURED.	GOOD RESULTS.
Bottini	30.4 %	84.4 %
Perineal	60.0 %	88.0 %
Suprapubic	66.0 %	90.0 %

TABLE II.—CAUSES OF DEATH.

OPERATION.	URÆMIA	SEPSIS.	SHOCK.	PULMONARY COMPLICATIONS.
Bottini	27.0 %	52.0 %	5.0 %	8.0 %
Perineal	35.0 %	17.8 %	21.4 %	17.8 %
Suprapubic	34.0 %	8.6 %	30.0 %	22.0 %

TABLE III.—ACCIDENTS OF OPERATION, INCLUDING ORCHITIS, IN-CONTINENCE, PERMANENT FISTULÆ, ETC.

Bottini	22.0 %
Perineal	7.2 %
Suprapubic	6.0 %

It is interesting to note that for years the mortality of supra-
pubic prostatectomy (McGill) when combined with lithotomy
has been less than when no calculus was present. Burckhardt
[212] gives 13.8 per cent. mortality (4 deaths in 29 cases) for the
former operation, and 20.8 per cent. (16 deaths in 77 cases) for
the latter. This difference can only be explained on the assump-
tion that the presence of the stone necessitated operative inter-
ference earlier, and while the patients were more able to endure

an operation, than when no calculus existed; for as far as the other circumstances (cystitis, etc.) are concerned, the patient with calculus is in a worse condition for operation than one without.

The death-rate from McGill's operation (partial suprapubic prostatectomy) has always been higher, and will always, it seems, remain higher than that of the operation advocated by Mr. Freyer. I say it will remain higher, because, however much critics may carp, it is not the same operation as Freyer's, and no matter how much its technique is improved, the suprapubic enucleation of prostatic tumors from the substance of the gland will always remain a bloody and dangerous undertaking. Very different is the case when the enlarged gland is removed entire, or in its two primitive divisions. Here the hæmorrhage is astonishingly slight, and is readily controlled by the hot douche; but where the substance of the prostate is divided the hæmorrhage is persistent and free. The removal of a pedunculated intravesical outgrowth, already referred to as a proper procedure under many circumstances, is not open to these objections. Its blood supply is derived from the pedicle, not from all surrounding tissues, as is the case with the prostatic tumor deeply imbedded in the gland, and its removal is safely accomplished by dividing its base.

The results of McGill's operation in the hands of various well-known surgeons may be seen in the following table.

McGILL'S OPERATION.

OPERATOR.	CASES.	DEATHS.	MORTALITY PER CENT.
Armstrong [8]	9	4	44.44
Fuller [92]	5	o	0.0
Horwitz [126]	5	1	20.0
MacGowan [154]	21	5	23.8
Thorndike [227]	9	1	11.11
	49	11	22.45

Belfield in 1890 collected 88 cases of McGill's operation with 12 deaths, a mortaity of 13.6 per cent.; and Moullin in

1892 collected 94 cases, with 19 deaths, or 20.2 per cent. mortality.

There is no dispute as to the fact that the total suprapubic prostatectomy advocated by Freyer is a preferable operation to the form of prostatectomy formerly employed by McGill; even those surgeons who assail the former's claim to originality acknowledge the advantages of the method employed. I was myself formerly an advocate of the perineal as the preferable operation, because of the difficulties and dangers attendant upon McGill's suprapubic method; but when I saw Mr. Freyer's excellent results, and appreciated the force of his arguments, I was emboldened to attempt a similar operation, and was greatly surprised at the simplicity of the technique, and at the pleasant convalescence of the patient. This ease of performance is another argument in favour of the suprapubic route. For although mere facility of execution by the surgeon is in itself no valid argument in favour of one operation rather than another, provided this other would secure better results and entail less danger to the patient, yet in Freyer's operation the ease consists not alone in mechanical execution, but in rapidity of performance, less distortion of neighbouring parts, and a shorter convalescence; all of which are factors of much importance in old prostatics.

As seen from Watson's tables, quoted above, the danger to be apprehended from uræmia is about equally great in the suprapubic and perineal operations, while that from sepsis is less than half as great in the former. On the other hand, the suprapubic operation produces greater shock, and these patients are slightly more liable to pulmonary complications. (In my own experience shock in the suprapubic operation has been comparatively slight.) But when we place against these objections the final results, as shown in the first table, where we see that ninety per cent. of the suprapubic operations are classed as good results, and two-thirds as absolute cures, it seems to me that its superiority is evident. Mr. Freyer states that he has been so happy as to secure a per-

fect urinary recovery in every case; I have myself not been so
fortunate. For although my results have been better than when
I employed the perineal operation exclusively, yet in a few cases
slight urinary difficulty (frequency and burning) has persisted.
Yet as is evident from Watson's third table, evil consequences,
such as fistula, incontinence, and so forth, are least apt to follow
the suprapubic operation.

The perineal operation, as I have already stated, I think,
with Moullin [177] and other surgeons, is best confined to those
cases where the prostate is small, fibrous, and sclerosed; where
the removal of the floor of the prostatic urethra and the main
part of the lateral lobes of the prostate will lower the vesical
orifice sufficiently to make a clear water-way; and where there
is little chance of the only portion of the prostate left (the superior
commissure) subsequently enlarging and causing renewed ob-
struction. Where the prostate is of the character described it
is usually impossible, or at all events extremely difficult, to enu-
cleate it from within its sheath; and a more or less exact dis-
section is required. To accomplish this through a suprapubic
wound is nearly impossible, since the prostate is at such a dis-
tance from the surface; but when it is well drawn down into
the perineum by tractors of some variety, such a dissection may
usually be accomplished. I have not myself found it necessary
to resort to the elaborate technique and extensive dissection
employed by Albarran [2], Proust [196], and Young [261], be-
lieving, with Goodfellow [98] and Syms [221], that everything
requisite can be accomplished through a straight median incision.
Yet did I expect to remove the entire prostate through the peri-
neum in a case where its enucleation was impossible, and dis-
section was required, I should be inclined to adopt a transverse
or Λ-shaped incision, so as to widely separate the rectum from
the anterior structures by transverse division of the perineal centre
and the "recto-urethral muscle," and thus bring the whole field
of operation before my eyes. I am not fond of dissecting with

a knife or scissors except where my dissection is in full view. But, as I said before, it is usually quite sufficient to remove so much of the prostate as can be readily reached through the median incision.

As to the preservation of the ejaculatory ducts, I regard this as entirely unnecessary. As shown in a former chapter, it is extremely improbable that semen without the admixture of prostatic fluid is fertile; and the destruction of these ducts need not of itself cause impotence. Impotence often exists before the operation; and although it has been stated that removal of the prostate may restore sexual potency, yet of this I am not very sanguine; but I do know of one patient, whose prostate I enucleated by Freyer's method, who told me that he was able to have pleasure from sexual intercourse after convalescing from the operation, which before the operation had been painful to him.

It will be seen from the preceding paragraphs that I prefer suprapubic prostatectomy as the radical treatment for the majority of patients. Indeed, since first adopting this method I have not seen a case in which it did not seem preferable to the perineal operation; but I recognize the fact that there are cases where the perineal is to be peferred, and when I encounter such, I shall not hestitate to adopt the latter procedure.

TECHNIQUE OF OPERATIONS, INCLUDING THE PREPARA-
TION OF THE PATIENT, WITH THE AFTER-
TREATMENT.

Preparation of the Patient.—The preparation of the patient is essentially the same no matter by which route—suprapubic or perineal—the prostate is to be removed.

These are not emergency operations, and the patient should be under preparation for the operation for at least forty-eight hours. In the case of many patients the surgeon will have been in attendance for weeks or months; but even such patients require further preparation than mere surgical attention. This preparation should be both general and local. As constitutional treatment it is well to pay special attention to the condition of the kidneys, the heart, and the lungs.

In treating the kidneys the state of the urine must be considered. It should be acid, fairly clear from pus, mucus, blood, etc., and should be excreted in quantities not too far removed from the normal. An exceptionally low percentage of uræa will render the operation much more dangerous unless the total quantity of urine excreted is correspondingly increased; yet I have successfully removed the prostate of a patient in whom there was present only eight-tenths of one per cent. of uræa. It should be constantly borne in mind that the total quantity of urine passed in twenty-four hours should be measured, and the percentage of uræa calculated from this quantity. All these matters may have been successfully attended to before any operation was decided upon, as advised under palliative treatment; but particular attention to these points must be paid during the day or so immediately preceding the operation.

For the heart it is usually well to prescribe a course of strych-

nine or digitalis, even if the cardiac action is not noticeably ab-
normal.   The shock of the operation is a strain on even a well-
preserved heart; but it may be much lessened by getting the
heart into training previous to the operation.   In my hospital
experience I have found that Resident Physicians are only too
apt to overdose the patient with strychnine after the operation,
while omitting it in the preparation.

The lungs should of course be free from acute disease, such
as bronchitis; and where a more or less chronic or subacute
bronchitis, hypostatic congestion, asthma, or emphysema is pres-
ent, special care should be exercised in the administration of the
anæsthetic, as well as in the prevention of chilling or exposure.
For such patients I prefer chloroform to ether.   Drugs directed
to the condition of the lungs are usually of little use, but if the
heart be treated the lungs may be benefitted indirectly.

It is not usually advisable to confine the patient to bed even
on the day immediately preceding the operation, unless he is
already bedridden: it is sufficient for him to regulate his life
with the utmost care for two or three days, confining himself to
the house, and taking special precaution to break no well-estab-
lished habit of life.   On the morning of the operation he should,
of course, remain in bed.   It is well to have the services of a
trained nurse for at least twenty-four hours before the operation.

The alimentary canal should be well cleaned out by a brisk
cathartic given in the afternoon before the operation, and the rec-
tum should be emptied by enema on the morning of the operation.
Should the afternoon cathartic not act, it is to be repeated early
in the evening or on the following morning, before the operation.
If, as has been advised, the patient has been in the habit of taking
a cathartic about once in a week or ten days, no difficulty will be
experienced in thoroughly emptying the intestinal tract without
the use of drastic purges.   Indeed, the routine administration of
cathartics to patients as practised in some hospitals in preparation
for operation, is debilitating in the extreme; the patient being in

no fit condition to undergo a serious operation after a sleepless and frequently disturbed night. I think that one good free movement, which may, as a rule, be procured by one dose (half an ounce) of epsom salts or of castor oil, together with an enema on the morning of operation, will evacuate the intestinal tract quite sufficiently; and I can see no sense in repeatedly purging patients until exhaustion is produced.

The diet for the few days preceding the operation should be light; and the supper the evening before may best be confined to fluids (milk, broth, gruel, milk-toast, etc.), and perhaps a soft-boiled or poached egg, with a little stale bread. If the laxative is taken before supper, such a meal will leave comparatively little residue, and this may be removed by an enema in the morning. Plenty of fluid may be taken up to within about six hours of the operation. This will flush out the kidneys, and help to refill the vascular system, which is always somewhat depleted if a saline purge is employed. If the operation is not to take place until afternoon, a light breakfast (broth or gruel) should be allowed, but this should be omitted when the operation is to be in the morning.

The extent of local preparation will vary somewhat with the patient. The lower class patient had best be given a tub bath, warm, in the afternoon of the day before the operation; but in a patient who is in the habit of bathing himself, such active cleansing will not be required. Some patients will not become decently clean until the bath has been repeated on several successive days, and will reacquire dirt at the least opportunity. When the demands of ordinary cleanliness are satisfied, the patient may rest until morning, when he should be shaved. It is always well to prepare for both suprapubic and perineal wounds, as some unforeseen complication may make it advisable to open in a place not anticipated. Hence the pubic and perineal hair both should be shaved; the skin of the abdomen, the groins, the genitals, the perineum, and the anterior and inner surfaces of the

thighs, should all be thoroughly washed first with turpentine, then with green soap and hot water, then with seventy per cent. alcohol, and finally with corrosive sublimate solution (1: 1000). A dry sterile dressing should then be applied to the abdomen and perineum, and should remain in place until removed on the operating table.

Proust has laid especial emphasis on the propriety of preparing the urethra of every patient who is about to undergo a prostatectomy. He thinks it extremely important to dilate the canal by the passage of sounds for some days before the operation, so as to insure the earliest possible restoration of urethral urination. But while I have no hesitation in dilating any strictures that may exist, yet I think that the routine dilatation of urethras which are apparently normal except for the prostatic obstruction is an unnecessary and therefore an undesirable performance.

We may then summarize the preparation for a prostatectomy as follows:

For two or three days regulate the patient's habits, heart, and kidneys.

On the day before the operation give a bath in the afternoon; give a cathartic before supper; for supper give only semisolid food; the bowels should be opened during the late afternoon or early evening. A good night's rest should follow. Fluid may be taken as desired until six hours before the operation.

On the morning of the operation an enema is to be given. Then shave and surgically cleanse the abdomen, perineum, etc. Apply the dressing, and wait for the operation.

Anæsthetic.—For the majority of these patients I think chloroform is to be preferred to ether. Especially is this the case when there is any pulmonary lesion. I am in the habit of commencing its administration myself, and only transferring this task to my assistant when the patient is thoroughly under its influence. I find that this method encourages the patient, and it obviates the possibility of any blame attaching to my

PLATE LXXVI.

SUPRAPUBIC OPERATION.

Skin incision exposing the sheath of the right rectus muscle close to the median line.

assistants should any accident occur. I say this, because I am perfectly well aware that chloroform is a dangerous drug. Wiener [250] advocates the use of laughing gas (hyponitrous oxide) in Freyer's operation, and has employed it seven times without a death. Goodfellow [98 a] has employed spinal anæsthesia exclusively in his later operations.

Suprapubic Prostatectomy.—The patient, being well covered with blankets and sterile sheets, is to have a soft-rubber catheter passed into his bladder. If such a catheter cannot be introduced the surgeon should select that instrument which from his previous experience with that patient he regards as most likely to succeed in passing the obstruction. Through this catheter the bladder is to be evacuated, and rinsed out with hot boric acid or saline solution (over 100° F.) two or three times, or until the fluid returns clear. About four ounces of this fluid should remain in the bladder, the catheter being clamped to prevent its regurgitation. The disadvantages of distention with air have already been referred to. (See page 170.) The patient is then raised into a moderate Trendelenburg position—about thirty degrees—and the suprapubic region uncovered. The surgeon, standing on the right of the patient, then makes his suprapubic incision, which in thin patients need not exceed two inches in length; but must be increased up to a limit of perhaps five or six inches where the abdominal wall is extremely fat. This incision, which I make to one side or other of the linea alba, usually to the right side, exposes the sheath of the rectus (Plate LXXVI). Its lower end should be at the symphysis pubis, neither above nor below. If annoying bleeding occurs from veins or arterioles, these should be clamped; the hæmostatic forceps may usually be removed as soon as the bladder is exposed, and will therefore not be in the way in the subsequent steps of the operation. Vessels of any size, which are rarely met with near the middle line of the abdomen, had best be ligated at once.

The sheath of the rectus is then opened, and its fibres sepa-

rated, longitudinally, by the handle of the scalpel, from their
pubic attachment below, up to but not quite as far as the skin
incision extends (Plate LXXVII). I regard this lateral incision
as of distinct advantage in decreasing the chances of the for-
mation of a permanent fistula. The wound thus made tends to
close spontaneously as soon as the drainage-tube is removed;
and although post-operative hernia in this situation is unusual,
it is by no means unknown.

The transversalis fascia and preperitoneal fat are then divided
with the scissors in the line of the skin incision; any decrease in
the length of the incision should be made at the expense of the
upper end of the wound; that is to say, the surgeon should aim
to work down on the anterior wall of the bladder, not up towards
its peritoneal surface. The layer of vesical fat will next be
exposed, lying below the prevesical reflection of the peritoneum.
The surgeon may then either pass the fingers of his left hand
down behind the pubis to the pubo-prostatic ligaments, and draw
this layer of fat bodily up towards the abdominal end of the
wound, or snip through it in the line of the original incision, with
his blunt-pointed scissors. I prefer the latter course. Retrac-
tors may be applied to each side of the wound, and aid by keep-
ing the structures to be divided fairly taut. Any hæmostatic
forceps which were used to clamp bleeding points in the abdomi-
nal wall may now be removed, since it will be found that such
vessels have ceased to bleed.

The large veins in the prevesical fat should be avoided if
possible. If the surgeon divides any, it is well to ligate them
at once. If possible, they should be ligated in two places before
being cut, the division between two ligatures maintaining the
wound dry, and enabling the surgeon to see clearly the field of
operation.

The prevesical fold of peritoneum is rarely seen in these
operations; the Trendelenburg position, even without the dis-
tention of the bladder, allowing it to recede above the upper

PLATE LXXVII.

SUPRAPUBIC OPERATION.

Separation of the fibres of the rectus muscle with the handle of the scalpel.

PLATE LXXVIII.

SUPRAPUBIC OPERATION.

The bladder has been exposed, below the prevesical fold of peritoneum, which can be seen across the upper angle of the wound. A tenaculum steadies the bladder, preparatory to its being opened.

limits of the wound. If it is seen, it is, as a rule, easily recognized, both by the typical appearance of peritoneum seen anywhere, and by the fact of its being a transverse fold; and it is easily detached from the bladder by blunt dissection. Should it unfortunately be opened, it should at once be sutured, and the perineum should be drained at the close of the operation.

The bladder is recognized by its blue appearance and its consistency. If any doubt exists as to its identity, it will be sufficiently manifested by injecting more fluid through the catheter. There are often large and turgid veins on its surface.

When the bladder is thus exposed, two retention sutures may be passed through its outer coats, about a half or three-quarters of an inch apart, equidistant from the proposed line of incision, and in its upper third. I formerly passed these sutures through the whole thickness of the abdominal walls as well, and let them remain at the conclusion of the operation, thinking thus to lessen the dangers of extravasation into the space of Retzius; but I think the likelihood of this danger is overestimated, and I have had more fear of causing an injurious anteflexion of the bladder; so that I no longer intend these for permanent sutures, but merely to act as guys during the enucleation of the prostate. If it is difficult to pass these sutures, on account of the depth of the wound, one may be made to suffice by placing it in the line of the incision, at the upper angle of the wound. Indeed, in my later operations I have found it quite sufficient to steady the bladder with a tenaculum until the finger reaches the prostate (Plate LXXVIII), and then to remove the tenaculum and let the bladder fall back into the pelvis during the enucleation.

The bladder, being thus securely fixed in the wound, is to be opened by an incision made towards the pubic symphysis, and extending below it. This incision in the bladder walls should never be made upwards, as not only might the peritoneum be opened, but a coil of intestine wounded as well. It is inadvisable to make an incision of more than an inch or an inch and a half

in length in the bladder wall, and the left index finger of the surgeon should follow the knife in, so as to palpate the inner surface of the bladder, the prostate, and the urethra, before all the fluid has escaped. A much more accurate idea of the relations of the various parts is attained when the bladder is distended.

The table may now be replaced in the horizontal position.

The finger should first seek to recognize the position of the urethra with its contained catheter. The outlines of the prostate can next be determined, the presence of calculi detected, and plans made for the further continuance of the operation. Any calculi present should first be removed, with forceps or scoop. If no guy sutures have been retained in the bladder it is best not to remove the finger from its interior until the completion of the operation, as its reintroduction may be difficult if the abdominal wound is deep. If a large calculus is found, the incision in the vesical wall may need to be enlarged before the stone can be safely removed; but with skill even large stones may be removed through an incision of little more than an inch. In very many cases retractors must be employed to draw apart the sides of the abdominal wound and the bladder wall before the prostate can be satisfactorily exposed. At times two other retractors may be used to advantage, increasing the field of operation in its longitudinal diameter (Plate LXXIX).

If a pedunculated prostatic outgrowth acting as a ball-valve against the vesical orifice of the urethra is found, it should be twisted off with the fingers, or its pedicle should be cut through with scissors or bladder forceps. If no other urethral obstruction exists,—a fact which can readily be determined by partially withdrawing and reinserting the catheter,—the operation may now be terminated, and the bulk of the prostate be left untouched. Often, however, there will be found similar prostatic tumors projecting into and obstructing the urethra, which are not evident from the cavity of the bladder; hence the great importance of making sure of the patulous condition of the urethra before de-

PLATE LXXIX.
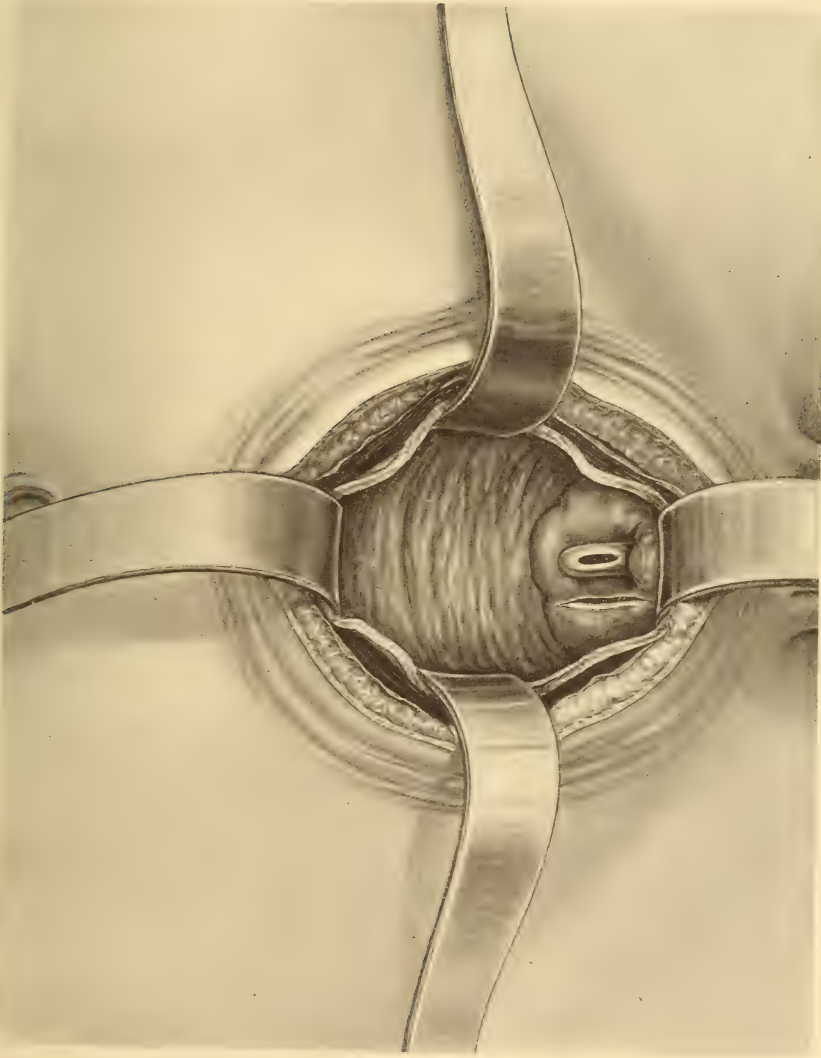
SUPRAPUBIC OPERATION.

The bladder has been opened, and by the use of retractors the field of operation is exposed sufficiently to show the enlarged prostate with the end of the catheter projecting from the vesical orifice of the urethra. An incision has been made in the vesical mucous membrane over the right lobe of the prostate, down to its capsule.

ciding to conclude the operation by a partial prostatectomy.   This is a point which has been much insisted upon by Belfield [18], and is probably the explanation of the failure of so many of the early suprapubic prostatectomies to effect a permanent cure.

If no such pedunculated outgrowth exists, or if a complete prostatectomy is indicated even after its removal, an incision, long enough to admit the end of the index finger, should be made over the more prominent of the two lateral lobes.   This incision should run parallel with the urethra, and is usually most conveniently made with a pair of scissors;   I have, however, on numerous occasions, simply scratched through the vesical mucous membrane with my finger-nail.   The surgeon then introduces the middle and index fingers of his right hand, gloved, into the patient's rectum, passing his arm beneath the flexed thigh;   and placing his thumb against the perineum, makes counterpressure on the prostate, and raises it up towards the enucleating finger. The larger and more adenomatous the prostate, the easier it is for the surgeon to find the natural line of cleavage which exists between the prostatic capsule and its sheath.   It is not safe to go too wide of the prostate in the endeavour to remove it all. All of it will be removed, except perhaps here and there a flake off the outer surface of its capsule, by clinging close to the adenomatous organ rather than by going off on voyages of discovery into the sheath.   In other words, the prostate is to be removed from its sheath, not the sheath from the prostate (Plate LXXX).

The finger should first pass to the outer side of the lateral lobe first attacked.   In this situation the attachment of the prostate to its sheath is least dense.   Then the finger should cautiously but not timidly work down and under the lateral lobe, towards the neighbourhood of the posterior commissure and the ejaculatory ducts.   Next the posterior and inferior surfaces are separated from the sheath;   and, finally, when the lobe is pretty well outlined, the finger may pass along the lateral and inferior surfaces to the apex, and free it from the triangular ligament.

At times the lateral lobe first attacked may come away alone, leaving the urethra still attached to the other lateral lobe. More often in my experience the original incision through the vesical mucous membrane has torn larger during this enucleation, and the vesical orifice of the urethra has become entirely detached by the extension of the tear across the trigone of the bladder. Then the enucleating finger will pass across to the second lobe, almost invariably as it does so tearing loose the ejaculatory ducts from their union with the urethra; and finally, having completed the enucleation of this second lobe, will find the prostate fully detached from all its surrounding structures except where the urethra annexes it to the triangular ligament.

At this stage of the operation either one of two things happens —the urethra slips out from the centre of the prostate, remaining still attached to the triangular ligament, and hanging loose like the empty finger of a glove (with its end cut off) in the cavity from which the prostate has been enucleated; or, which I think is more frequently the case, the urethra tears off at the triangular ligament, and its prostatic portion is removed entire in the centre of the prostate. I do not see how it is possible, and know it has never been so for me, to leave the prostatic urethra, with the attached ejaculatory ducts in place, annexed at both ends— anteriorly to the triangular ligament, posteriorly to the bladder wall. I have several times been able to remove the entire prostate, including of course its urethra, through the one original incision made through the vesical mucous membrane; but where the organ is very large this cannot be satisfactorily done, and a second incision, comparable to the first, must be made over the other lateral lobe. If the anterior commissure of the gland gives way during these manipulations it is theoretically possible to swing the whole prostate (which is then merely an organ with the urethra lying in a groove on its upper surface) across beneath the urethra, and to deliver it entire through one or other of the incisions in the mucous membrane of the bladder; but even thus

PLATE LXXX.
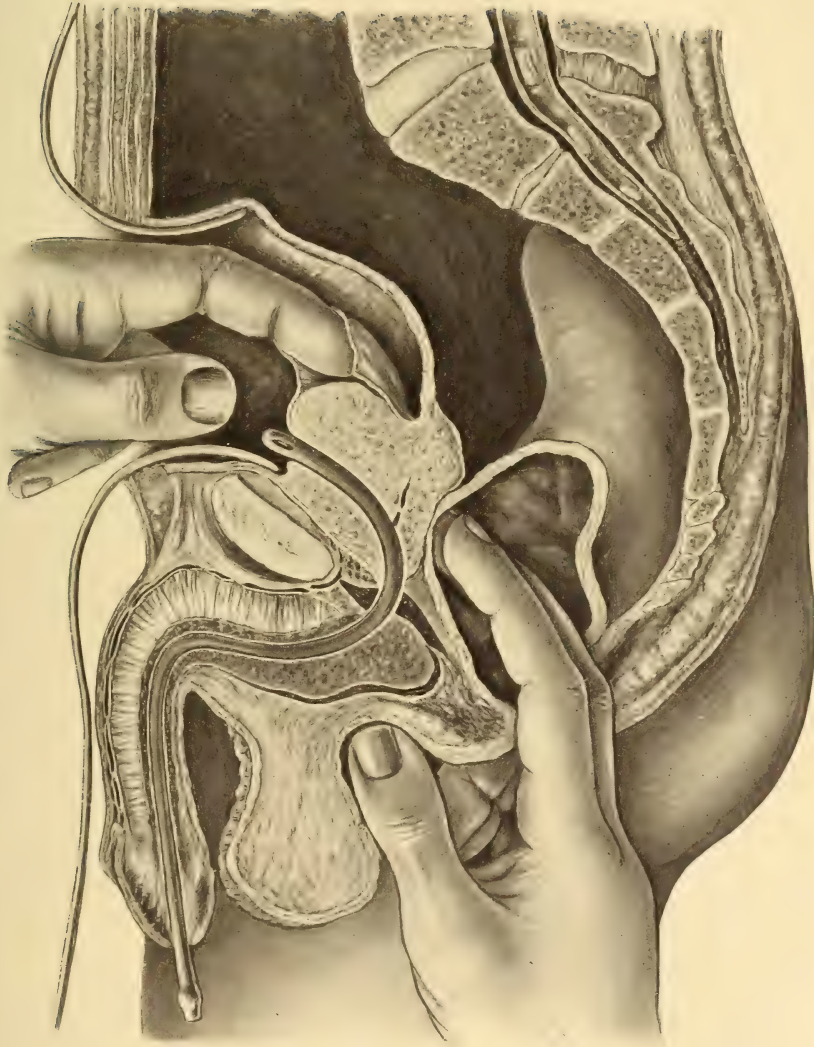
SUPRAPUBIC OPERATION.

Sagittal section of pelvis, showing finger enucleating the prostate from its sheath, as counter-pressure is made
by the other hand in the rectum and the perineum.

PLATE LXXXI.

APPEARANCE OF PARTS AFTER THE COMPLETION OF FREYER'S OPERATION, SHOWING THE
REMNANTS OF THE PROSTATIC URETHRA, ATTACHED BELOW TO THE TRIANGULAR
LIGAMENT AND ABOVE TO THE BLADDER. BETWEEN THE DIVIDED ENDS OF THE
URETHRA ARE SEEN THE REMAINS OF THE EJACULATORY DUCTS.—(*Walker*.)

I cannot see how the attachment of the ejaculatory ducts can be preserved, though it is theoretically possible for the prostatic urethra to remain intact, traversing the cavity from which the prostate has been removed much as a resistant artery traverses a phthisical cavity.

The condition of the parts which is probably the most usual is shown in Plate LXXXI taken by Mr. J. W. T. Walker from one of Freyer's patients who died two hours after the operation. Here two tongue-like processes can be seen, representing the remains of the urethra, extending downwards from the vesical mucous membrane, and upward from the triangular ligament; while between and below these can be seen the ejaculatory ducts, torn loose from all connection with the urethral floor.

When the prostate has thus been delivered into the interior of the bladder, the tissues left between the rectal and vesical hands are felt to be very thin, and no trace of remaining prostatic substance can be detected. The hand is then withdrawn from the rectum, the glove removed, and the prostate extracted from the bladder with the fingers or suitable forceps. The more adenomatous the prostate, the more compressible it will be, and the vesical incision should not be enlarged until attempts to remove the prostate have failed.

The cavity from which the prostate was enucleated will now be found to have become amazingly reduced in size, both by active contraction, and by pressure from the surrounding structures. Bleeding may be free, but is usually only moderate in amount, and readily controlled by the hot douche, which is to be freely applied through the suprapubic wound.

Should this fail to control the hæmorrhage another plan must be tried. Often by gauze pressure well directed against the oozing area the bleeding may be checked. But if the hæmorrhage persists, or in case of secondary hæmorrhage, continuous pressure must be applied. It has been advised to apply this in the following way: a number of layers of gauze, of suitable

16 P

size, are stitched together at their centre; the end of the suture is left long, and is attached to the intravesical end of the catheter which has been lying in the urethra throughout the operation, or which is to be introduced if not already in place. By withdrawing this catheter, the thread will follow, and will press the attached gauze firmly against the vesical orifice of the urethra. Care should be taken that this gauze does not occlude the ureteral orifices.

This method of hæmostasis has always seemed to me to be objectionable. When the gauze becomes soaked through with urine there is risk of its acting merely as a sponge, and thus allowing the blood to ooze through its meshes. A safer plan, I think, is to pack with gauze the cavity from which the prostate has been enucleated, and then to suture over the packing the mucous membrane forming the roof of the cavity from which the prostate has been removed, of course leaving an end of the gauze long, to come out through the suprapubic wound, and facilitate its removal. The suture material should be catgut, and the packing could remain in place until it became loosened by the absorption of the catgut—usually in from four to five days. I have recently adopted this plan with the most gratifying results in a case where furious bleeding followed the removal of an adherent prostate by Freyer's method. Of course, if this method were adopted for the control of secondary hæmorrhage, the patient would have to be anæsthetized and the suprapubic wound enlarged. For secondary oozing which is not marked irrigation with hot water will usually be found an efficient hæmostatic; or a solution of adrenalin chloride (1 : 10,000) may be used. It is certainly well to try the effect of milder measures first, and not resort to packing injudiciously.

As soon as the prostate is extracted from the interior of the bladder, the urethral catheter, if not previously withdrawn, is to be removed; and a long rubber tube of large calibre—one-quarter or three-eighths of an inch—passed into the bladder

PLATE LXXXII.
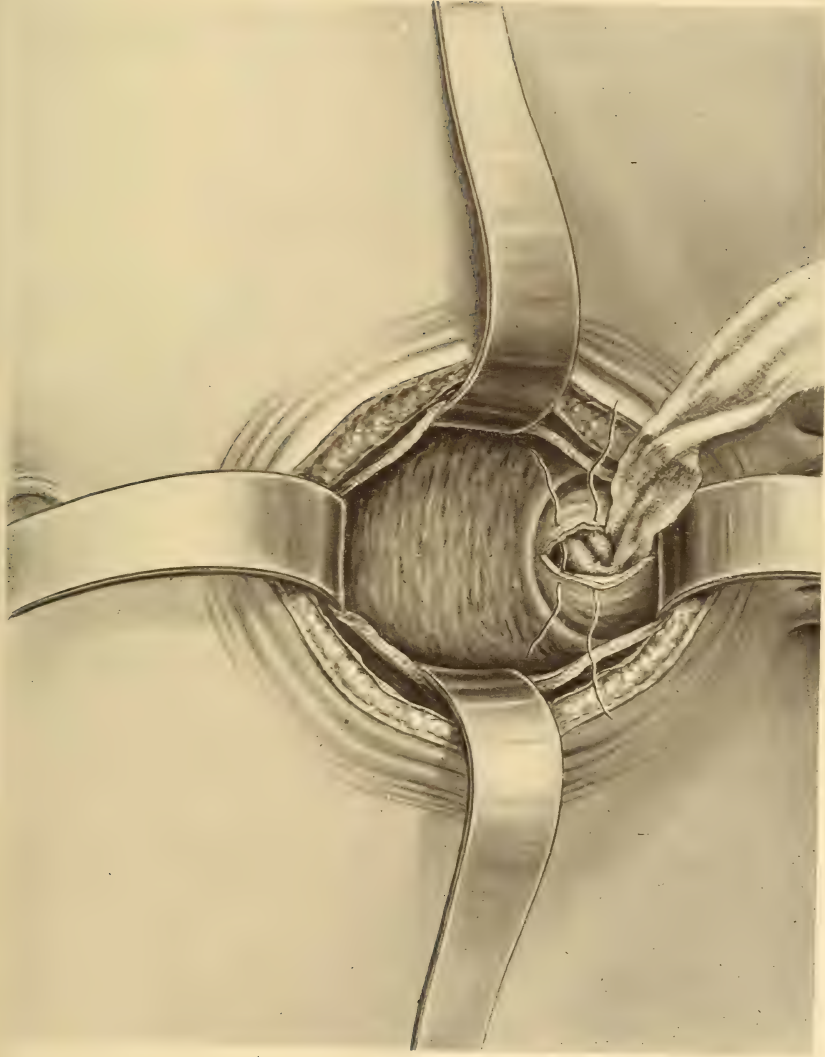
SUPRAPUBIC OPERATION.

In case of persistent haemorrhage the cavity from which the prostate has been enucleated is packed with gauze, and the margins of the vesical mucous membrane sutured over the packing with catgut

through the suprapubic wound. This tube should be about two feet long, and I am careful to have it open not only at the end, but also to have large eyes on its sides near the vesical end, since should the bladder wall come in contact with the end opening, all drainage would be effectually prevented. To further obviate the likelihood of any such obstruction I do not pass the tube far into the bladder, merely making sure that it fulfils its purpose as a drain; and under no circumstances dismissing the patient from the table until it is evident that the tube is clear of all clots and other obstructions, and the urine or intravesical fluid can be seen distilling from its further end drop by drop.

The anæsthetic may be stopped as soon as the irrigation of the bladder is commenced; and by the time the patient is in his bed he should be fairly conscious of his surroundings.

The suprapubic tube is held in place by a stitch through the skin; and the angles of the wound, when this is large, may be sutured, but if the urine is foul no sutures at all should be employed; but as the parietal peritoneum has a tendency at times to prolapse into the upper angle of the wound, one suture in this situation may be necessary. Separate catgut sutures should be used for the sheath of the rectus muscle and for the skin. The dressing, of sterile gauze, cut so as to fit around the tube, and each piece overlying that beneath in an imbricated manner, should be copious, and may be reinforced with absorbent cotton. Thus whatever urine is not carried off by the tube, but leaks out along its sides, will be quickly absorbed in the dressings, and will not trickle over the patient's buttocks and clothing.

The further end of the tube must be connected with a suitable receptacle below the level of the patient's bladder, so that the syphonage may be continuous. If this detail is attended to there will be no necessity for the employment of a vacuum pump, as described by W. G. Richardson [199] in his recent essay. The urinal into which this suprapubic tube drains should be partly

filled with some antiseptic or deodorant solution, sufficient in depth to cover the end of the tube; and in calculating the amount of urine excreted the quantity of fluid already in the urinal must be subtracted.

The suprapubic dressing may be renewed as often as it becomes saturated. As a rule, twice daily is quite frequently enough.

Should there be much shock after the operation, suitable stimulation must be administered; but it is of more importance to prevent shock, and for this purpose nothing is so efficacious as external heat. The patient may be surrounded with hot-water bags throughout the operation in many cases with the greatest advantage, or, better still, be placed on a hot-water bed.

On the day following the operation, and once each subsequent day, the bladder is douched through the suprapubic wound. I do not retain a catheter in the urethra, nor do I pass one to irrigate the bladder, after the operation, until this can no longer be accomplished through the suprapubic wound. But if an ammoniacal state of the urine developes I think great advantage is to be derived from douching the bladder through the urethra, the fluid draining off by the suprapubic wound. For the purpose of intravesical douching in these cases it is usually quite sufficient to introduce the nozzle of the syringe into the urinary meatus, there being no necessity to pass a catheter into the bladder, since the passive resistance of the urethra can readily be overcome by fluid pressure. The suprapubic tube may usually be removed on the second day after the operation, and the patient encouraged to pass his urine in the natural way; but there is no objection to leaving the tube in place for five or six days if such a course should seem desirable. Voluntary micturition commonly returns earlier after this operation than after that by the perineal route; and, as there is no fear of a sinus persisting below, the patient may be propped up in bed on the fourth or fifth day, and be allowed to sit in a chair at the end of a week or ten days if

PLATE LXXXIII.
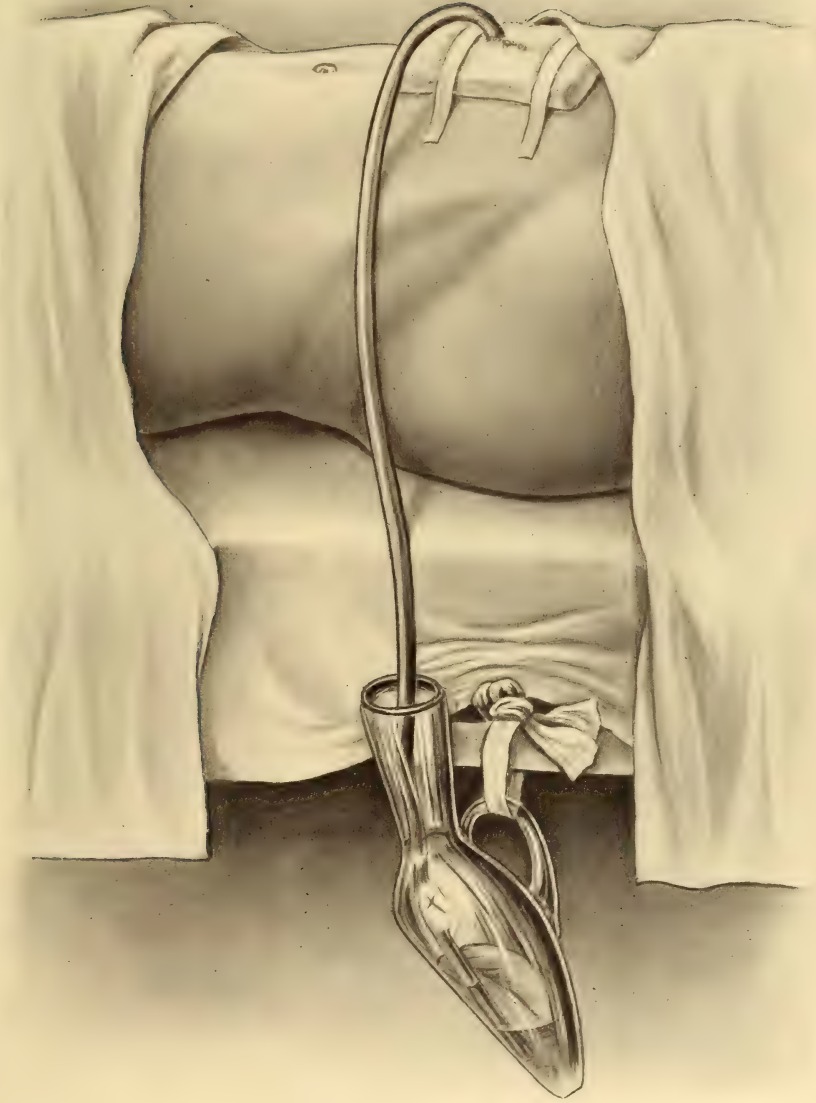
SUPRAPUBIC OPERATION.
Drainage-tube and dressing in place.

his general health permits. Indeed, as soon as the patient feels able to be out of bed, no matter how few days have elapsed since the operation, I think he should be allowed to be up.

Unless something should indicate the existence of urethral obstruction, I am not in the habit of passing instruments by this route as long as the suprapubic wound remains available for the daily irrigation of the bladder. Should, however, this fail to show any signs of closing in the second week, I think it proper to sound the urethra, so as to ensure against the formation of strictures. I do not regard it as at all impossible for strictures to form as a result of the removal of the prostatic urethra; but I think the injudicious resort to instrumentation might very well render their formation more probable. When, however, the suprapubic wound has closed, which it commonly does in the third or fourth week, I consider it safe to irrigate the bladder through the urethra; and this, I think, should be done at least once a week for some months after the operation, unless the urine sooner becomes normal. In any case, the regular passage of a full-sized sound once a week for some months after the operation can be productive of no harm, and should, I think, be advocated in most cases, especially where a tampon has been employed for the control of hæmorrhage.

Some surgeons have found that the suprapubic wound is apt to reopen once or twice before finally healing; but this has not been my experience.

Secondary hæmorrhage and the means of controlling it have already been referred to; but I think it important to call attention to looseness of the bowels as a cause of this complication. Every time the bowels are opened the granulating wound is disturbed, and the liability to bleeding increased. Hence diarrhœa should be avoided, and where slight oozing persists it may be well to try the effect of opium or paregoric before more strenuous measures are resorted to.

The patient's usual diet and mode of life may be resumed as

rapidly as his convalescence will permit; but he should pay particular attention to the state of his kidneys and urine for many months after the operation. He should be encouraged to drink all the water possible from the instant his stomach becomes retentive after recovery from the anæsthetic; this is the surest method of preventing uræmic conditions. The appearance of hiccough and nausea following the recovery from anæsthesia, particularly if a small amount of urine is being excreted, is indicative of a mild degree of uræmia, and should be promptly met by medical measures. It is not my practice to resort at once to agents such as calomel, sparteine, caffeine, etc., after operation, but to immediately wash out the stomach with the stomach-tube, this being a far more effective remedy for hiccough than any antispasmodic drug; I then introduce into the stomach one and a half or two ounces of Glauber's salt in concentrated solution. Where the stomach is empty the solution soon finds its way into the small intestine, and in a short time bowel action is obtained. I have found this of more service than any other agent. Should further treatment be required, however, rectal, subcutaneous, or intravenous infusions of decinormal saline solution should be employed, and other appropriate, treatment should be instituted, as already indicated at page 162.

Perineal Prostatectomy.—So many variations and modifications of this operation are now in use, that a minute description of each in a work of this kind would be impracticable. All the methods employed, however, may be classed in either one of two categories—those operations where an elaborate dissection is required, as seen in the technique of the French school developed by Proust [196], and as modified in this country by Young [261]; and those operations where only a partial prostatectomy is performed, the manipulations being conducted through a comparatively small perineal wound. The latter is the form of operation which I have employed myself, and which is, I believe, that most generally adopted by operators in this
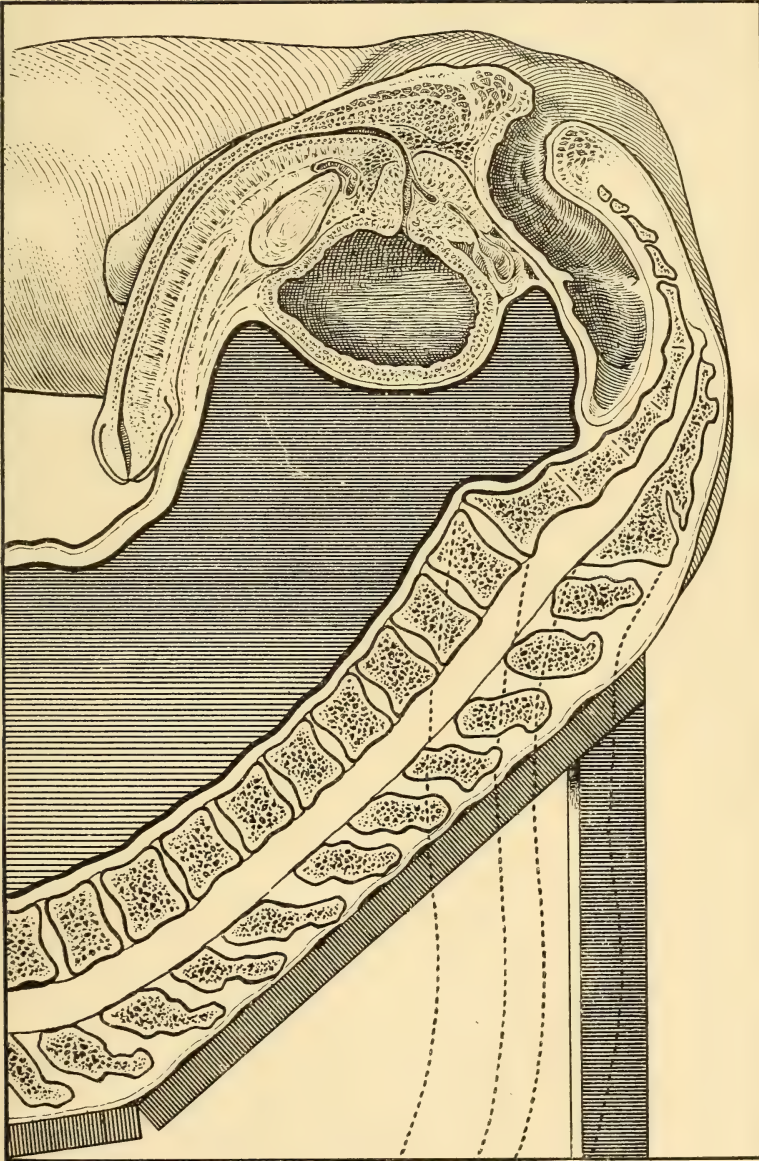
PLATE LXXXIV.

Proust's Inverted Perineal Position for Perineal Prostatectomy.

PLATE LXXXV.

PERINEAL PROSTATECTOMY.—(*Proust.*)
The transverse perineal incision.

country. The technique employed by Dr. Goodfellow, as already remarked, appears to me to differ in no essential particulars from that of Mr. Freyer, except that the prostate is removed through a perineal instead of a suprapubic wound. Dr. Goodfellow's [98] own description of his operation is as follows: "The usual pre-operative procedures are carried out. . . . With the patient in the ordinary lithotomy position, the legs held by assistants, the bladder being empty or full as the case may be, a lithotomy staff is introduced, the legs then elevated somewhat, a median incision from the base of the scrotum to the margin of the anus is made, and carried to the membranous urethra, which is entered with a straight lithotomy knife and the opening extended *into* the bladder. The finger is then introduced *into* the bladder, the staff removed, and the moderate flexion of the legs and thighs on the abdomen and the thorax increased to as great an extent as possible; then with the opposing hand over the hypogastrium the bladder is depressed, and the enucleation, beginning at the beak of the prostate below and working upward next to the bladder, or from above on either side downward, is carried on, the time consumed for complete enucleation rarely being over five or ten minutes, the resulting hemorrhage being virtually nothing. The gland may be removed entire or lobe by lobe. . . . What becomes of the prostatic urethra? has been asked. The answer is that part or all is removed with the gland, an incident that in no manner seems to affect the restoration or the continuity of the urethra, nor the power of the bladder to regain and control its functions; nor is stricture or occlusion caused. The seminal ducts are not ligated, for this seems to me an irrational refinement, especially as many of my patients have (so they say) to a greater or less extent regained sexual vigor."

Dr. Goodfellow continues: "The points to be expressly emphasized are the position and the incision *into* the bladder. . . . . I do not find it necessary now to use the knife to

enter the urethra and bladder. After cutting to the urethra I am able with the finger to open it and get into the bladder by a boring movement. Then not having a cut through the commissure, I enucleate from above instead of from below as formerly."

1. *Perineal Prostatectomy. Technique of Proust.*—Perineal prostatectomy as practised by Proust requires a special operating table, and special retractors. The patient is placed in the "inverse lithotomy position," so that the perineum is in the horizontal plane, its surface looking upward. (Plate LXXXIV.) To secure this the patient's lumbar spine and sacrum are placed upon an inclined plane of forty-five degrees, and his legs are held by special stirrups high in the air, with the thighs fully flexed and horizontal. By means of this position it is claimed that a very much larger operative field in the perineum is exposed, since, after division of the recto-urethral muscle, and opening of the aponeurosis of Denonvilliers, as will be presently described, the rectum and anus can be drawn upward against the coccyx and lower bones of the sacrum, making a yawning wound. For this purpose a self-retaining retractor is employed, and the aid of an assistant may be dispensed with.

The patient being fixed in the position above described, his bladder being empty, and a metal guide or catheter in the urethra being held close beneath the pubic arch, so as to draw the bulb of the urethra well up out of the operative field, a transverse incision is made in front of the anus, with its convexity forwards, from one ischiac tuberosity to the other. The attachment of the external sphincter ani to the perineal centre is then divided, and the dissection continued posterior to the transverse perineal muscles. By drawing the anus backwards, that is, towards the operator, the recto-urethral muscle is put upon the stretch (Plate LXXXVI). This is a somewhat indefinite structure which consists of muscular and fibrous tissue passing from between the layers of the triangular ligament backwards to the rectum, by

PLATE LXXXVI.
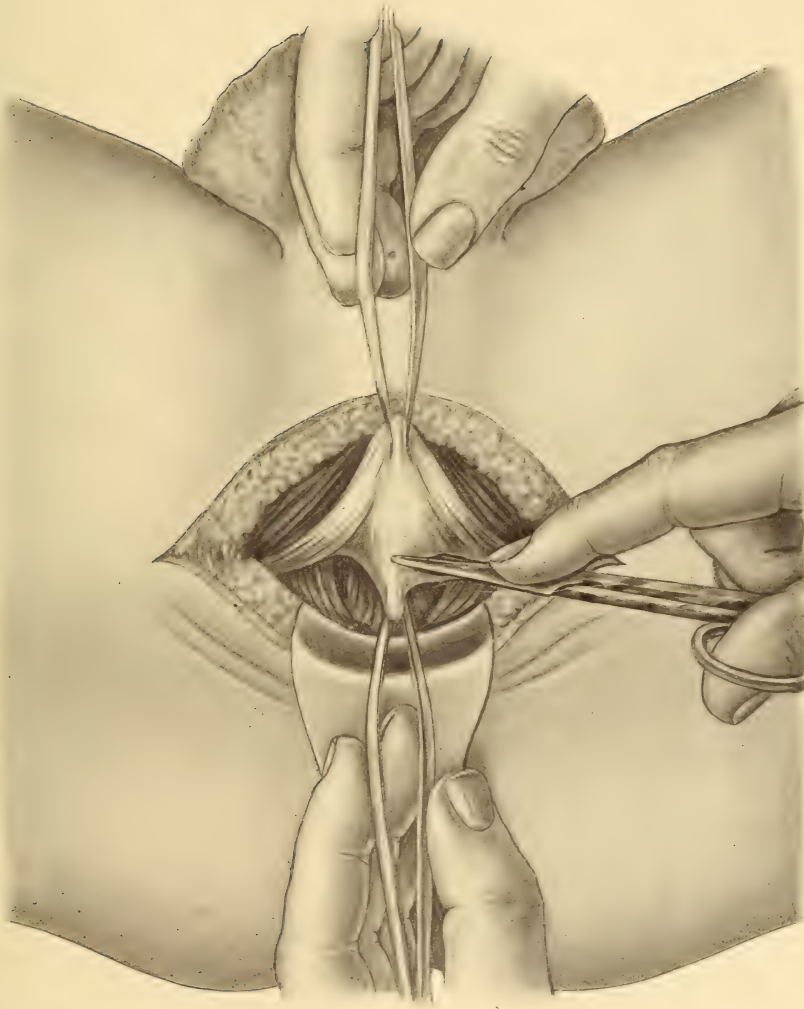
PERINEAL PROSTATECTOMY.—(*Proust.*)

After dividing the skin, and separating the insertion of the sphincter ani from the perineal centre (which is raised by forceps in the right hand of an assistant), the recto-urethral muscle is exposed, and is now being divided with scissors, close to the membranous urethra.

Plate LXXXVII.
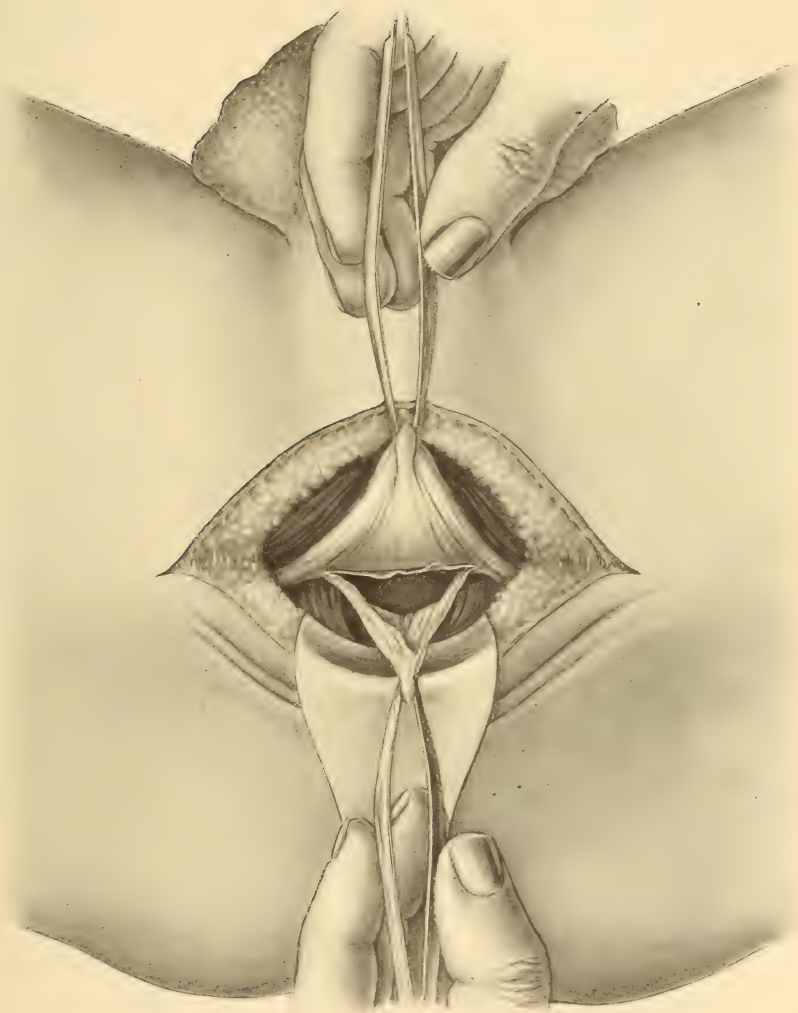
Perineal Prostatectomy.—(*Proust.*)

The recto-urethral muscle has been divided, allowing the rectum to fall away from the anterior structures, and opening the "*espace décollable rétro-prostatique.*"

PLATE LXXXVIII.

PERINEAL PROSTATECTOMY.—(*Proust.*)

The two index fingers of the operator are introduced between the two layers of the apo
neurosis of Denonvilliers, and enlarge the "*espace décollable rétroprostatique*."

PLATE LXXXIX.

PERINEAL PROSTATECTOMY.—(*Proust.*)

The sheath of the prostate (the anterior layer of the aponeurosis of Denonvilliers) has been opened, and the surgeon's finger now detaches the sheath from the prostate by blunt dissection The prostatic tractor sometimes employed by Proust is not shown in this illustration.

their insertion into which is produced the acute flexure of this canal just within the anus.

The recto-urethral muscle must next be divided. This is to be done with a pair of scissors, snipping through these fibres close to the membranous urethra. If great care is not exercised to keep close to the membranous urethra, but without opening it, the dissection will be made below the posterior layer of the aponeurosis of Denonvilliers, between it and the rectum, instead of between the two layers of this structure (Plates XV, LXXXVII), where is found the "*espace décollable rétro-prostatique*."

As soon as the recto-urethral muscle has been divided in the required place, the rectum will fall away from the anterior structures, and the two layers of the aponeurosis of Denonvilliers may be readily separated with the two index fingers (Plate LXXXVIII). The rectum will now appear like a loop of intestine floating free in the peritoneal cavity, being covered by the posterior layer of this aponeurosis, while the anterior layer still conceals the prostate and seminal vesicles from view. It is to be recalled that the aponeurosis of Denonvilliers is really an obliterated sac of peritoneum. (See pages 24 and 31.)

When the "*espace décollable rétro-prostatique*" is thus widely opened, the special retractor is inserted, and screwed up so as to hold the rectum and anus against the sacrum and coccyx.

Beyond the anterior layer of the aponeurosis of Denonvilliers the prostate can now be indistinctly felt, floating away as soon as it is touched. Proust now opens the urethra, at the apex of the prostate, posterior to the triangular ligament, not between its layers; and after withdrawing the guide, inserts into the bladder through the urethral incision a special tractor—DePezzer's—which is very similar to that employed by Young, and represented in Plate XCIV.

The prostate being thus steadied by spreading the blades of this tractor over its vesical surface (Plate XCV, Fig. 1), the sheath of the prostate (the anterior layer of the aponeurosis of Denonvilliers)

is to be opened with scissors, parallel to the urethra. The finger
of the surgeon is then inserted between this layer of fascia and
the capsule of the prostate, which is thus exposed on its rectal
aspect; and the surgeon proceeds to detach the prostate from its
sheath by the finger (Plate LXXXIX). He detaches it first along the
side of one lateral lobe, then below, and from the vesical aspect, and
finally in front, above, and close to the pubis. This enucleation
should be done deliberately, and with the most painstaking
thoroughness. Proust says that time apparently lost at this
stage of the operation will at a later stage be found to accelerate
matters considerably. When the prostate is thus freed of all
its attachments, except those to the urethra, and to the ejacu-
latory ducts, the operation may proceed, but not before. The
prostatic tractor is then removed.

The wound in the urethra is now to be enlarged. This is
accomplished by splitting its floor from the apex of the prostate
to but not into the neck of the bladder (Plate XC). This cut
hemisects the prostate as well; and each lobe in turn is then
dissected off the lateral and upper aspects of the prostatic urethra
by means of scissors, the index finger of the left hand being
placed on the mucous surface of the prostatic urethra if neces-
sary as a guide (Plate XCI). Proust ligates the ejaculatory
ducts, thinking that by this means orchitis is less apt to occur.
He removes each lateral lobe entire, advising against morcelle-
ment, which he considers necessary only when the gland is
extremely friable and comes away in pieces of its own accord.
He follows Albarran in the practice of resecting the floor of
the prostatic urethra when this part of the canal is unduly
dilated.

When an intravesical projection, more or less pedunculated,
is present, he delivers this through the prostatic urethra, and
accomplishes its removal just as if he was working through a
suprapubic wound; or if the pedicle is too short or too broad
to allow of its delivery in this manner, he works up from the

PLATE XC.
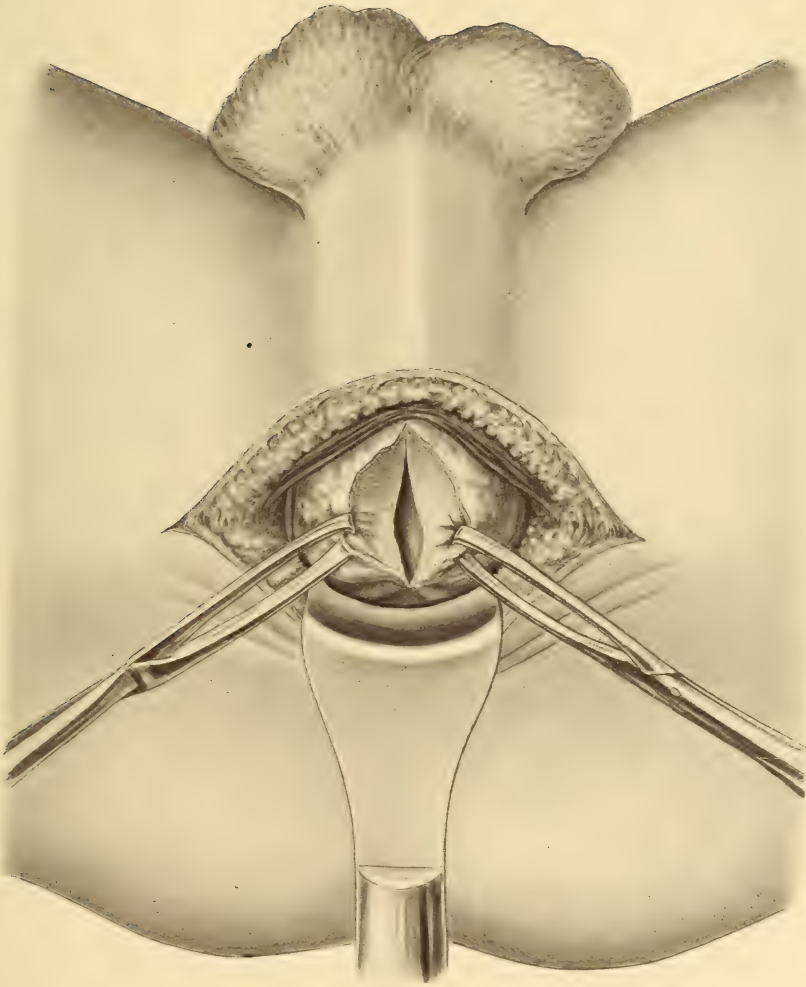
PERINEAL PROSTATECTOMY.—(*Proust.*)
Hemisection of the prostate along the floor of the urethra.

PLATE XCI.

PERINEAL PROSTATECTOMY.—(*Proust.*)
Each lobe of the prostate in turn is dissected free from the sides of the prostatic urethra.

PLATE XCII.
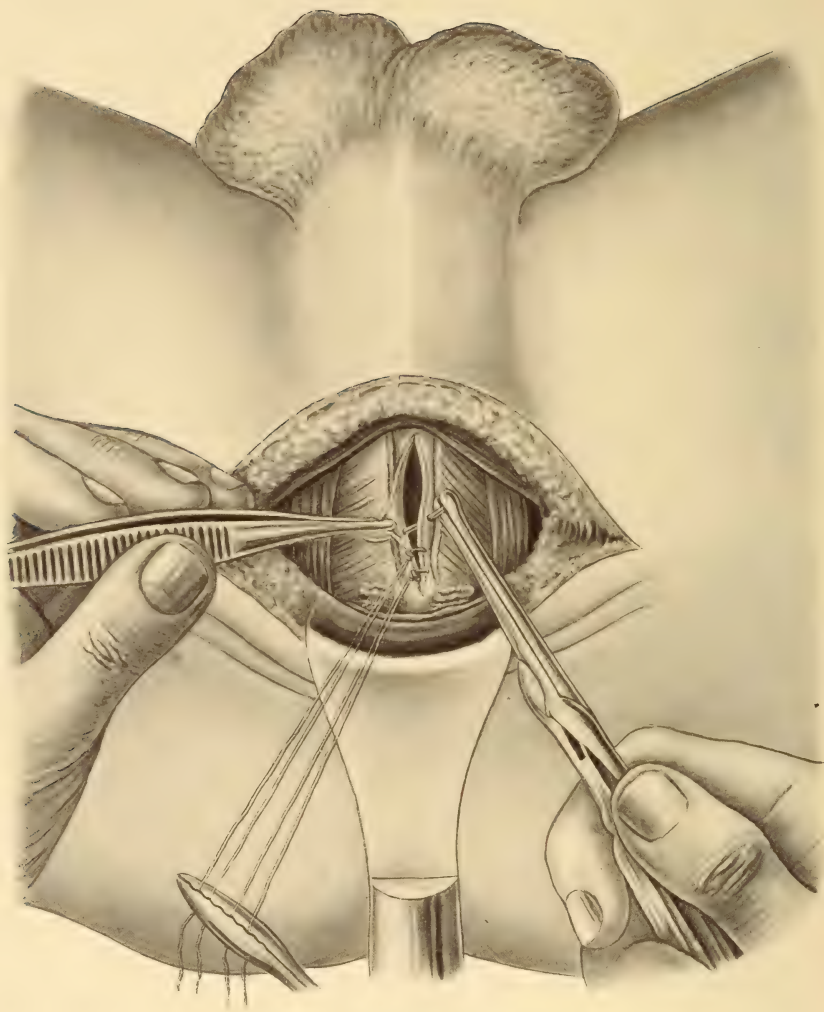
PERINEAL PROSTATECTOMY.—(*Proust.*)
The ejaculatory ducts have been ligated, and the urethra is now being sutured.

lower surface of the bladder, and enucleates the mass without opening the vesical mucous membrane.

The operation is completed by passing a rubber tube or catheter through the penis into the bladder, and another catheter to the bladder through the perineal wound. Ordinarily the calibre of the prostatic urethra is such that it will easily accommodate both these tubes; should such, however, not be the case, that through the penile urethra is to be omitted.

The prostatic urethra is sutured around the perineal tube with interrupted stitches of catgut, except where the tube emerges, at the triangular ligament (Plate xcii). Three wicks of gauze are required to drain the perineal wound, which is partially closed by a few buried sutures, and by two deep (not buried) sutures at each of its angles. A firm gauze pad is placed between the coccyx and the anus, so as to hold the rectum forward, its normal anterior support having been destroyed by the division of the recto-urethral muscle. The usual superficial dressings are applied; and the patient when returned to bed is so arranged that the bladder shall be higher than the outer end of the perineal tube. This is best accomplished by using a perforated mattress, and having the tube drain into a urinal beneath the bed. If this plan cannot be carried out, Proust advises placing a board across the bed beneath the mattress, where the patient's buttocks will rest upon it, and thus be effectually prevented from making a depression in the bed lower than the outer end of the tube, which would then have to drain up-hill. As a substitute for this plan, the patient's buttocks may be made to rest upon a firm pad or pillow, placed above the mattress. Some such device Proust insists is essential to ensure the proper drainage of the bladder. The penile catheter is plugged, and all urine passes by the perineal tube.

In the after-treatment, the bowels are kept locked for eight days; for the first week the bladder is irrigated twice daily by injecting small quantities of fluid through the penile catheter,

and allowing it to escape by the perineal tube.   The dressing is first removed at the end of forty-eight hours, and subsequently renewed once every day.   He removes the perineal tube on the eighth day, and lets the urine then drain by the penile catheter. This should be changed frequently to prevent concretions forming on it; and in doing so the upper wall of the urethra should be sedulously followed.   Proust employs catheters of the general form of Mercier's, but having an extra eyelet on the convexity of the angle; before withdrawing one he passes a straight flexible guide along its interior until the guide projects through this extra eyelet into the bladder; the catheter is then withdrawn over the guide, which remains in the urethra, and serves as a conductor for the insertion of the new catheter.

He prefers to keep the penile catheter in place, changing it frequently, for from three to five weeks, that is, until the perineal wound has closed.   Complete healing of the perineal wound is generally assured in from five to seven weeks.

2. *Perineal Prostatectomy.   Technique of Young.*—Young [261] calls his method "conservative" perineal prostatectomy, its special feature being the preservation of the connection between the ejaculatory ducts and the urethra.

The incision he employs is shaped like an inverted V (Plate xciii).   At first he used an incision like an inverted Y, but he has found that the prolongation of the incision forwards on to the bulb of the urethra is not necessary, inasmuch as the entire dissection, just as in Proust's technique, is carried on posterior to the perineal centre and the transverse perineal muscles.   Each limb of his Λ-shaped incision is five centimetres or less in length.

The position he advises may be characterized as the "exaggerated lithotomy position," the patient's thighs being fully flexed on the abdomen, so as to bring the perineum more nearly parallel with the floor.

With a guide in the urethra, the attachments of the anus
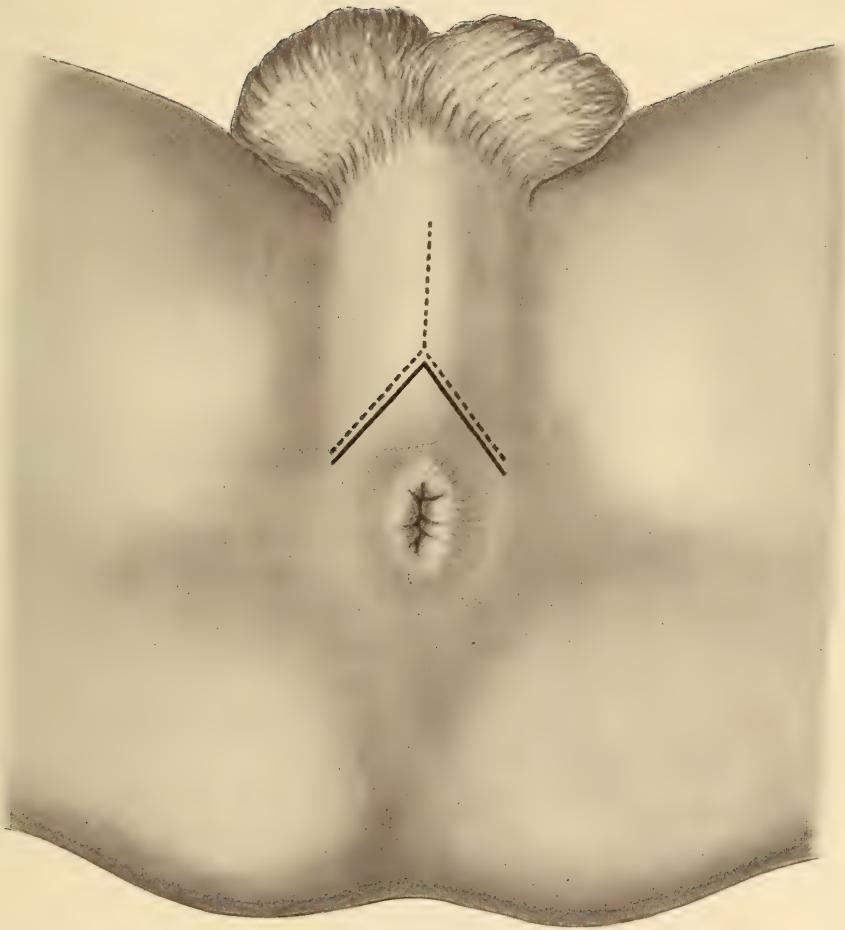
PLATE XCIII.

SKIN INCISIONS FOR PERINEAL PROSTATECTOMY.

PLATE XCIV.

YOUNG'S PROSTATIC TRACTOR.

PLATE XCV.
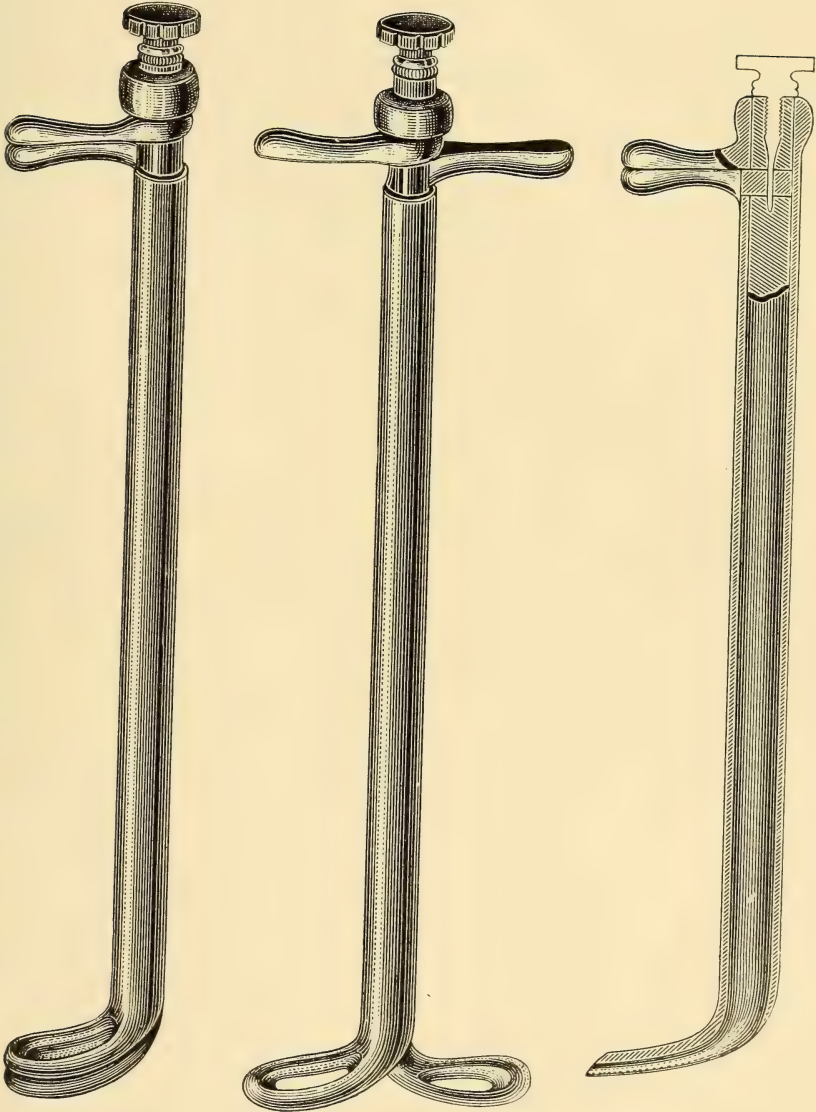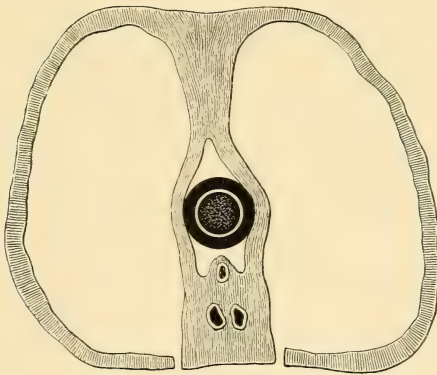
FIG. 1.

FIG. 2.

PERINEAL PROSTATECTOMY.—(*Young.*)

Fig. 1. Young's prostatic tractor in place, seen from within the bladder. Fig. 2. Diagram to show parts removed in operating according to Young's technique: in the centre a catheter is seen in the prostatic urethra; below are shown the ejaculatory ducts and uterus masculinus in the posterior commissure of the prostate.

PLATE XCVI.
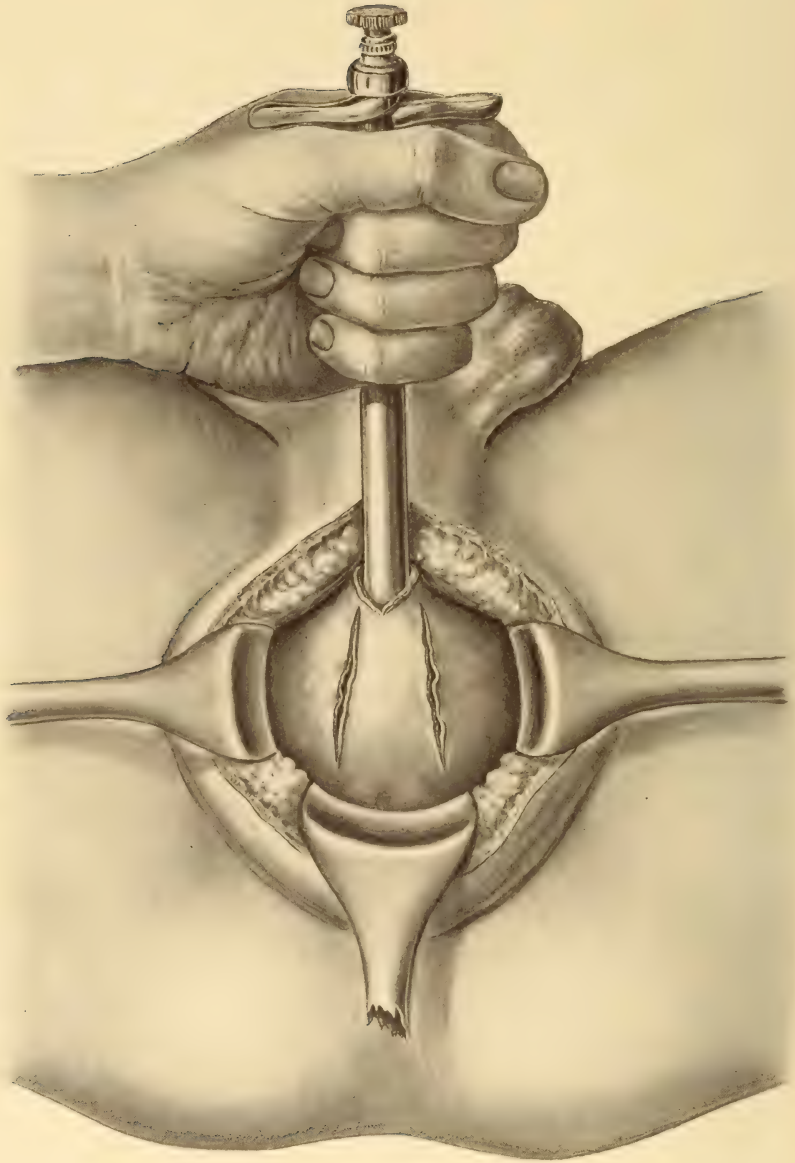
PERINEAL PROSTATECTOMY.—(*Young.*)

Incisions on each side of posterior commissure down to the prostatic urethra. The prostatic tractor has been introduced through the opening in the membranous urethra, and draws the prostate well down into the perineum.

to the perineal centre, and of the rectum to the triangular liga-
ment, are divided as in the French operation; the "*espace décol-
lable rétroprostatique*" being thus opened, an incision is made
into the membranous urethra. The edges of the urethral in-
cision are caught with silk traction sutures, or suitable clamps,
and the urethral guide withdrawn. The prostatic tractor (Plate
xciv) is then inserted into the bladder through the perineal wound;
by spreading its blades the prostate can be drawn securely down
into the perineal wound. An incision is now made with a scalpel
on each side of the median line, through each lateral lobe of the
prostate, parallel to and extending as deep as the urethra; leav-
ing between these two incisions a bridge of prostatic tissue, in-
cluding the posterior commissure, in which the ejaculatory ducts
are supposed to lie (Plate xcvi). Each lateral lobe of the pros-
tate, lying external to the corresponding incision, is then detached
from its sheath with a blunt dissector and the finger. When one
lobe has been freed from its sheath, its connections to the urethra
and the anterior commissure are severed, and it is removed.
The second lobe is treated in a similar manner. Thus prac-
tically all that remains of the prostate is the anterior and pos-
terior commissures (Plate xcv, Fig. 2).

A median lobe frequently, when present, is removed at the
same time as the lateral lobe to which it is attached. If it does
not come away in this manner, Young says it is easily enucleated
through the upper end of one of the cavities left by removal of
a lateral lobe. This is aided by placing one blade of the tractor
over the vesical aspect of the median lobe.

At the conclusion of the operation the lateral prostatic cavities
are to be packed firmly with gauze, additional packing being
also placed in the retroprostatic space. One limb of the incision
is closed completely, and through the other, which may be partly
closed posteriorly, the gauze and rubber drains emerge. He
employs two perineal tubes, so as to maintain continuous irriga-

tion, which he finds necessary to prevent the plugging of the tube by clots.

The continuous irrigation of the bladder through the perineal wound (Plate xcvii) he continues for a week, the reservoir requiring to be filled every half hour with saline solution at a temperature of from 110° to 120° Fahrenheit.

As soon as the patient is returned to bed, a subcutaneous infusion of salt solution is given.

The perineal gauze is loosened on the second day, but is not completely removed until the sixth day after the operation. The tubes are removed at the end of a week, and the patient is allowed out of bed. The perineal wound is still kept lightly packed with gauze, and on the ninth day, after passing a sound by the urethra, a catheter is inserted and fixed in place, constant drainage by the penile urethra being maintained for five days more. The bladder is irrigated twice daily through this catheter. The perineal fistula may be expected to close in five or six weeks. Sounds are passed by the urethra only at intervals, not systematically.

3. *Partial Perineal Prostatectomy.*—The technique about to be described is, I think, that still most widely employed in this country, and that which is usually intended by the term "perineal prostatectomy."

An ordinary staff, or Ferguson's prostatic depressor, being in the urethra, the patient is brought into the lithotomy position, his legs being supported by assistants. It is undeniable that by flexion of the thighs on the abdomen the perineal distance is decreased, and this manœuvre may aid in the removal of the offending organ. But I have known femoral thrombosis and gangrene of the leg to result from overflexion of the thigh in one patient where vaginal hysterectomy was the operation, and have since been averse to this exaggerated position for any operation upon the perineum.

A straight median incision is then made from the base of the

PLATE XCVII.
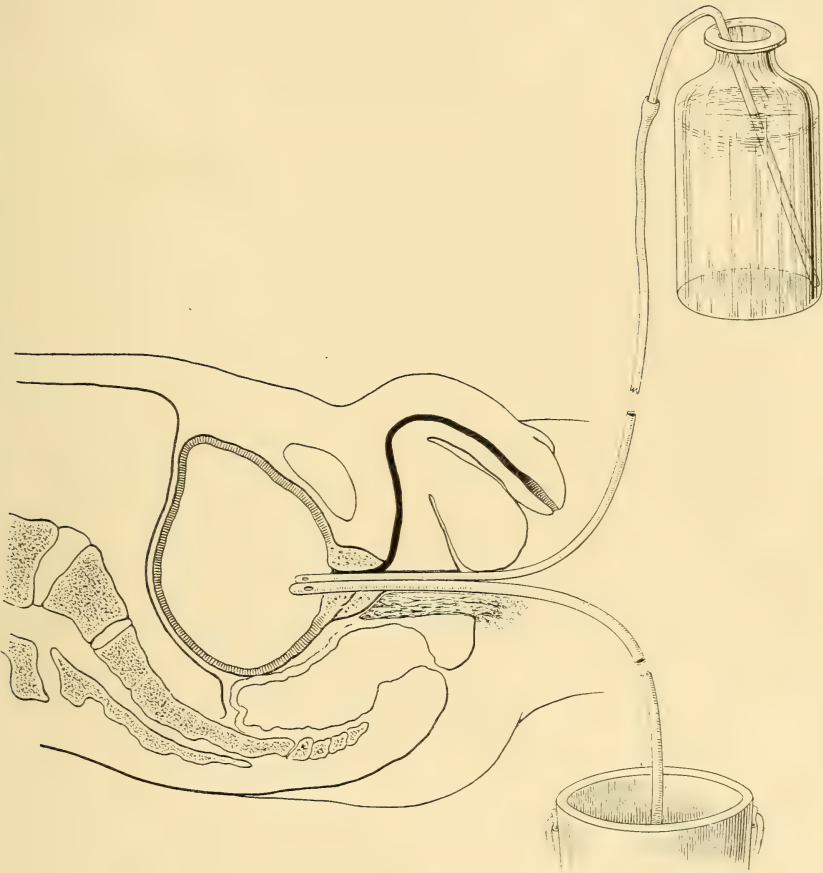
DIAGRAM SHOWING THE USE OF CONTINUOUS IRRIGATION OF THE BLADDER, AFTER
YOUNG'S OPERATION OF PERINEAL PROSTATECTOMY.

PLATE XCVIII.
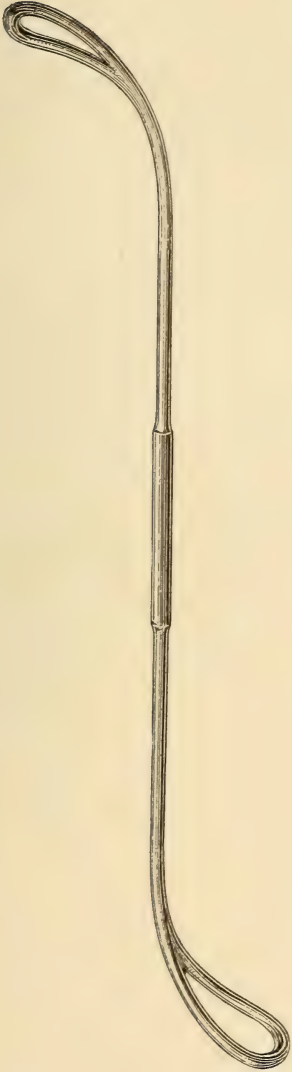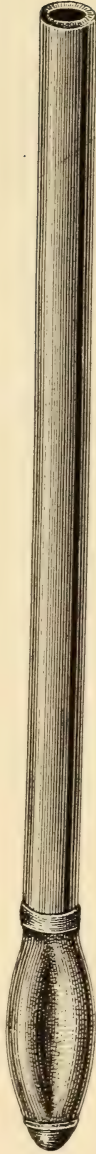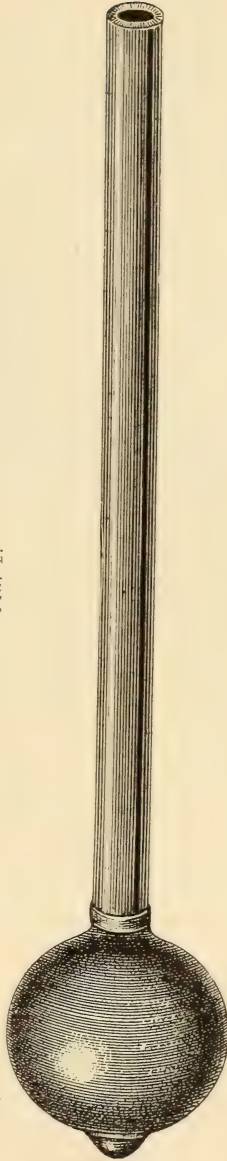
FIG. 1.

FIG. 2.

FIG. 3.

Fig. 1. Ferguson's prostatic depressor. Fig. 2. Syms's prostatic tractor, collapsed, and ready for introduction through an opening in the membranous urethra. Fig. 3. Syms's prostatic tractor, distended, as it is after its introduction into the bladder.

PLATE XCIX.
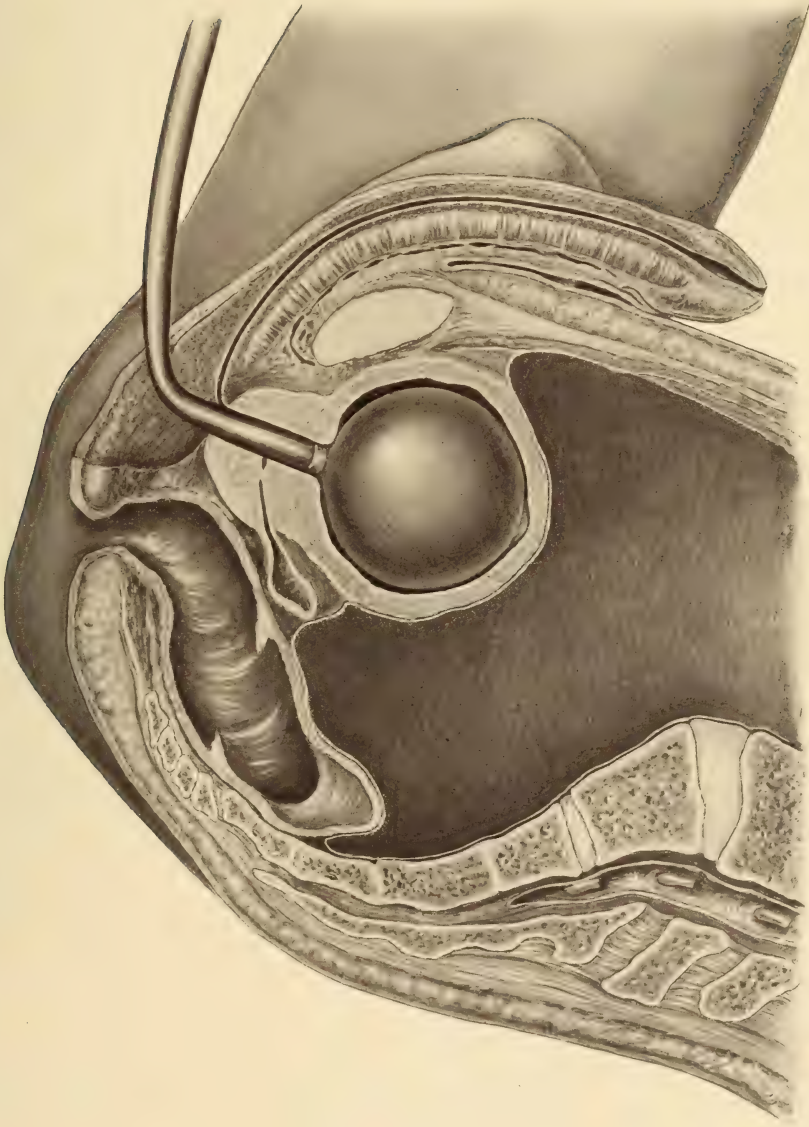
SYMS'S PROSTATIC TRACTOR IN USE.
Its bulbous extremity has been expanded within the bladder, and by traction on the stem
the prostate is drawn down into the perineum

PLATE C.
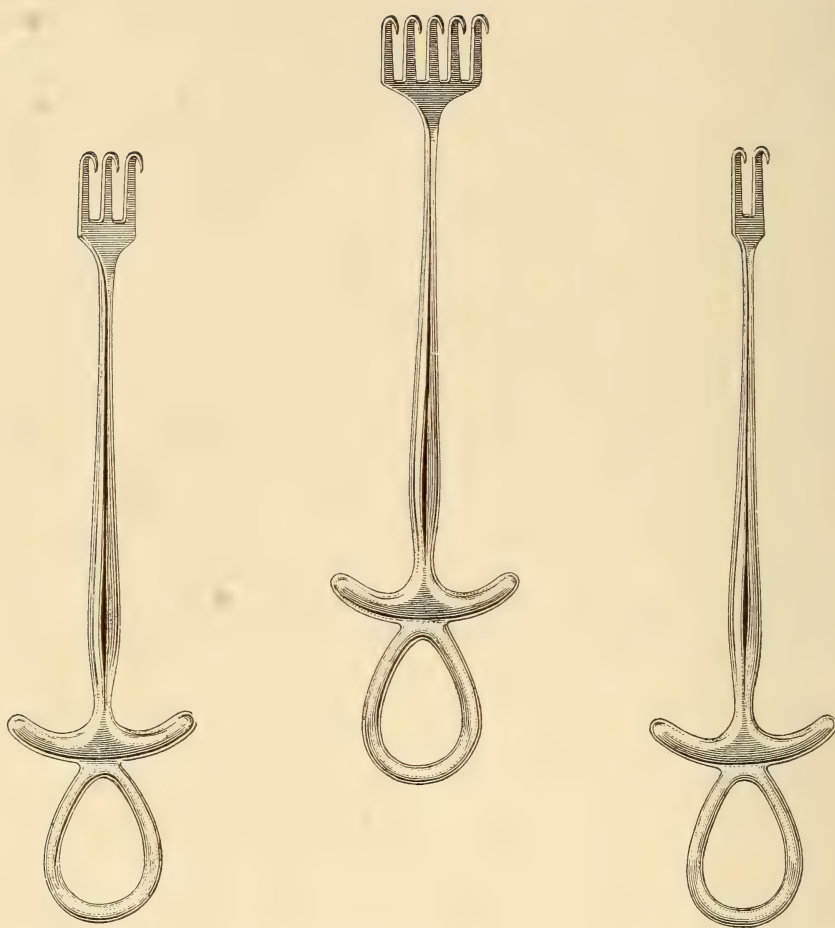
MURPHY'S HOOKS, FOR USE IN PERINEAL PROSTATECTOMY.

scrotum to the margin of the anus. This incision lays bare the bulb of the urethra anteriorly, and the outer fibres of the anal sphincter posteriorly. This incision is deepened by light touches of the knife, dividing the perineal centre, and exposing the membranous urethra. On each side of the wound the fibres of the levator ani will be seen descending, those most anterior passing in front of the rectum and blending with fibres of the deep transverse perinei and internal sphincter ani muscles, near the perineal centre.

The membranous urethra should now be opened, and, the staff being withdrawn, an ordinary metal sound, or the finger, passed through the prostatic urethra into the bladder; by hooking this over the raised vesical orifice of the urethra the prostate may now be drawn down into the wound. If Ferguson's prostatic depressor is employed it should not be removed from the urethra, but an assistant should, by bearing down on it, push the prostate down into the wound. I have no doubt that Young's or Syms's tractors are very useful during this part of the operation, but I have not found them necessary.

The anterior fibres of the levator ani are then divided, and drawn to each side by hooked retractors, while the rectum and its overlying tissues are pressed backwards with a blunt retractor. By this means a fairly large operative field is opened up in the recto-urethral triangle. It is not the gaping wound of Proust, nor even the free exposure of Young, but it is quite sufficient for the purpose (partial removal of small fibrous prostates), and amply large when the time for healing has arrived.

By now drawing the prostate down into the wound its sheath is put upon the stretch, and is readily opened, by two lateral incisions, parallel to the urethra. When this has been done, the separation of the prostate from its surrounding structures should be begun at its posterior part, which is readily reached by going along the lateral surfaces of each lobe. One lobe at a time is attacked, by drawing it down into the perineum by

means of Murphy's hooks (Plates c, cvii). This dissection is by no means so easy as the shelling out of the gland in the suprapubic operation, for these fibrous prostates are both hard, and usually closely attached to the surrounding tissues, so that removal by morcellement is at times imperative. Especially is this the case when the gland is of cartilaginous hardness. Here the most that can usually be done is to gnaw away the obstructing parts, along with the floor of the prostatic urethra, irrespective of lobes, which are often indefinable.

The floor of the prostatic urethra may well be removed in every case, sacrificing thus, of course, the ejaculatory ducts. It is generally best to leave behind the upper wall of the urethra, as well as the anterior commissure of the gland, since their removal prolongs the operation and makes it more dangerous, and since there is little likelihood of subsequent trouble being caused by their presence. In these fibrous prostates it is very unusual to find a pedunculated vesical outgrowth, but should one be present, it is best removed through the prostatic urethra, after dividing its pedicle.

When as much of the gland as seems advisable has been removed, and it is evident that the vesical orifice of the urethra is as low as the lowest part of the bladder, a good-sized rubber tube is passed into the bladder through the perineal wound, being stitched to the skin, and is gently packed around with iodoform gauze. If the oozing of blood is persistent, and cannot be controlled by douching with hot lotions, this packing may be quite firmly applied. It should be removed, as a rule, on the third or fourth day. A light gauze dressing, held in place by absorbent cotton and a T-bandage, completes the operation.

On being returned to bed the perineal drain is attached by glass and rubber tubing to a bottle hanging beside the bed. It is well to pay attention to the point so much insisted upon by Proust [196], and to see that the urine has a down-hill course from the bladder.
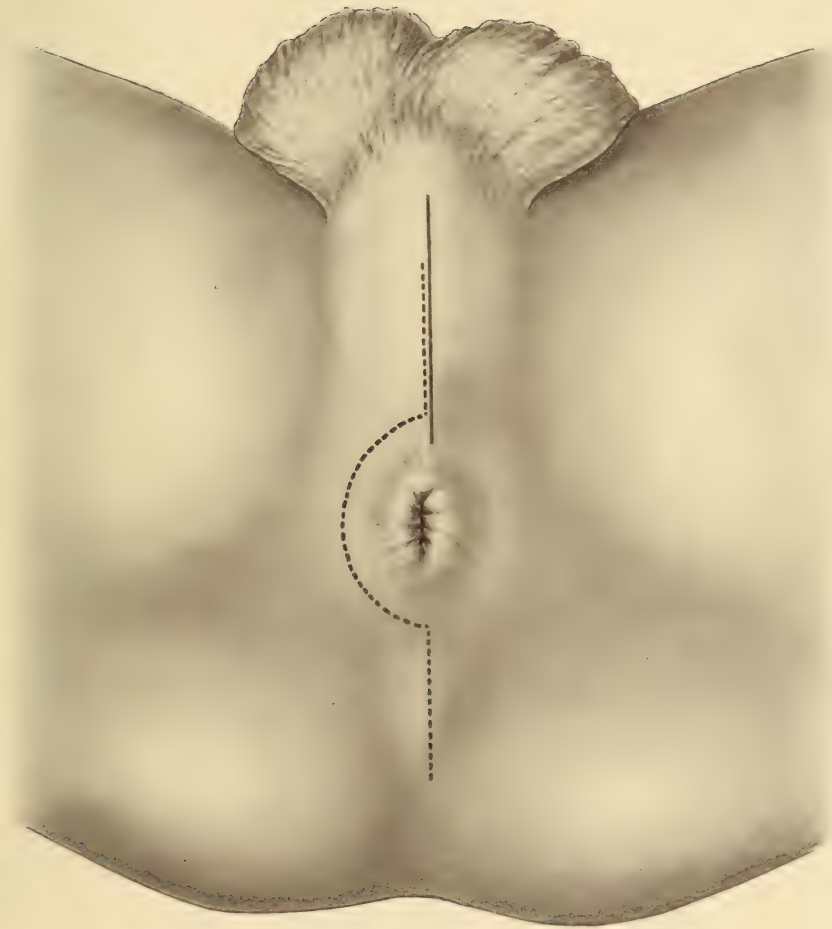
PLATE CI.

SKIN INCISIONS FOR PERINEAL PROSTATECTOMY.
The dotted line shows Dittel's incision. The unbroken line shows the incision employed
in the technique illustrated in Plates CII to CVIII.

PLATE CII.

PERINEAL PROSTATECTOMY.
Straight median incision exposing Colles's fascia

PLATE CIII.

PERINEAL PROSTATECTOMY.
Colles's fascia has been incised, exposing the bulb of the urethra.

PLATE CIV.

PERINEAL PROSTATECTOMY.

By retracting the margins of the wound the membranous urethra, the transverse perineal muscles, and the anterior fibres of the levator ani are exposed, in addition to the bulb of the urethra (bulbo-cavernosus muscle) shown in Plate CIII.

PLATE CV.

PERINEAL PROSTATECTOMY.

The membranous urethra is opened on a grooved staff, being more fully exposed by re-
tracting the rectal tissues downwards.

PLATE CVI.

PERINEAL PROSTATECTOMY.

By means of Ferguson's prostatic depressor the prostate is pushed well down into the perineum, displacing the bulb of the urethra forwards, and the levatores ani muscles to either side. The sheath of the prostate has been incised over each lateral lobe, parallel to the urethra.

PLATE CVII.
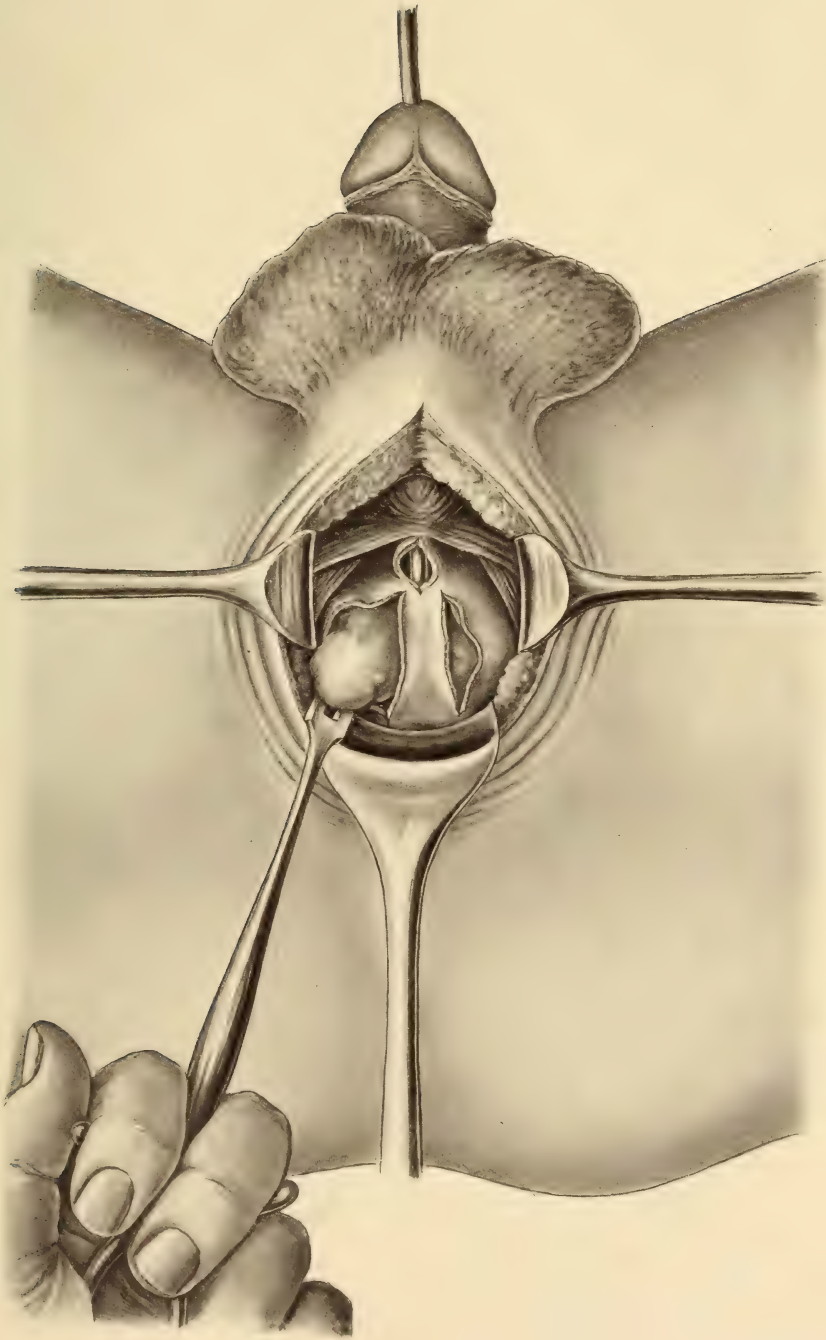
PERINEAL PROSTATECTOMY.

By blunt dissection, and with the aid of Murphy's hooks as tractors, each lateral lobe of the prostate is removed in turn. The finger or an ordinary sound may be introduced into the membranous urethra, if desired, and Ferguson's depressor withdrawn, to aid in the enucleation.

PLATE CVIII.

PERINEAL PROSTATECTOMY.
Drainage-tube in place, the wound packed lightly with gauze, and its angles sutured.

The outer dressings may be changed once daily, or oftener, if required; the packing should be removed about the fourth day, and the perineal tube at the end of a week. The bladder should be irrigated once daily through the perineal tube.

Commencing in the second week, a full-sized catheter or sound should be passed through the urethra every third or fourth day. It will commonly be found that by the end of the second week the patient will pass more urine by the urethra than through the perineal wound. He should be kept quietly in bed until the urine ceases to pass by the perineum, unless his general health suffers from the confinement. To encourage the voluntary passage of urine he may turn on his side or even into the prone position, early in the second week. The perineal fistula may be expected to close in the third or fourth week, and the wound to be completely healed at the end of five weeks.

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